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VOL. LIX MAY, 1949. No. 5

POLIOMYELITIS-TONSILLECTOMY SURVEY — 1948.*†

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In previous reports,[1,2,3] a review of the literature was presented regarding the relationship of tonsillectomy to poliomyelitis. There is no need to repeat those citations; but it is of interest to report that authorities now regard poliomyelitis not as a single disease entity caused by a sole agent, but rather as a group of diseases having in common certain clinical symptoms and caused by a family of more or less related viruses.

Investigators have presented evidence that at least three immunogenic types of polio virus exist, each type consisting of numerous individual strains. How many more of these types there may be still remains to be determined. It has also been reported recently that a human polio virus may be grown in extraneural tissue and that an experimental vaccine has successfully immunized monkeys. From all these reports, it may not be too optimistic to believe that within the near future a definite means of prevention or control of the disease may be possible, which will make the question as to a causal

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†From the Manhattan Eye, Ear and Throat Hospietal, New York, N. Y.

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TABLE I.

CASES OF POLIOMYELITIS — BY AGE — TYPE OF DISEASE — OPERATIVE PROCEDURES.

Age	Total Cases	Following T & A	Following Other Op.	Bulbar Total Cases	Bulbar Following T & A	Bulbar Following Other Op.	Spinal Total Cases	Spinal Following T & A	Spinal Following Other Op.	Mild Total Cases	Mild Following T & A	Mild Following Other Op.
0-5	4276	19	8	430	13	2	2667	5	6	1179	1	0
6-10	2594	17	7	365	11	1	1312	3	4	917	3	2
11-15	1454	1	6	250	1	1	688	0	3	516	0	2
16 and over	2300	2	11	436	2	3	1192	0	6	672	0	2
Total	10,624	39	32	1481	27	7	5859	8	19	3284	4	6

TABLE II.

TYPE OF DISEASE—OPERATIVE PROCEDURES—CASES OF POLIOMYELITIS BY STATE.

State	Total Cases	Following T & A	Following Other Op.	Bulbar Total Cases	Bulbar Following T & A	Bulbar Following Other Op.	Spinal Total Cases	Spinal Following T & A	Spinal Following Other Op.	Mild Total Cases	Mild Following T & A	Mild Following Other Op.
Vermont	18	0	0	4	0	0	12	0	0	2	0	0
Oregon	156	0	0	25	0	0	103	0	0	28	0	0
Arizona	82	1	0	8	0	0	54	1	0	20	0	0
Illinois	787	0	0	90	0	0	261	0	0	436	0	0
Kansas	272	1	1	42	1	1	163	0	0	67	0	0
Rhode Island	9	0	0	0	0	0	9	0	0	0	0	0
Maine	30	0	0	4	0	0	12	0	0	14	0	0
New Hampshire	17	0	1	1	0	0	10	0	1	6	0	0
Connecticut	120	0	0	10	0	0	75	0	0	35	0	0
Delaware	135	3	0	27	3	0	53	0	0	55	0	0
Louisiana	133	2	3	18	2	2	89	0	1	26	0	0
Arkansas	144	1	2	26	1	1	103	0	1	15	0	0
Alabama	147	0	0	6	0	0	91	0	0	50	0	0
S. Dakota	993	4	3	225	4	2	550	0	1	218	0	0
New Mexico	3	0	0	1	0	0	1	0	0	1	0	0
Texas	989	0	0	146	0	0	737	0	0	106	0	0
Massachusetts	115	0	0	8	0	0	55	0	0	52	0	0
Colorado	116	1	0	24	1	0	67	0	0	25	0	0
Utah	182	1	1	49	1	0	118	0	1	15	0	0
Wyoming	76	0	0	13	0	0	39	0	0	24	0	0
New Jersey	639	2	2	67	1	0	486	1	1	86	0	1
Missouri	187	0	0	32	0	0	112	0	0	43	0	0
Mississippi	123	0	0	6	0	0	69	0	0	48	0	0
N. Carolina	1227	3	3	155	2	0	660	0	2	412	1	1
Georgia	183	1	0	30	0	0	80	1	0	73	0	0
Ohio	970	4	8	131	1	0	485	2	5	354	1	3
N. Dakota	41	0	0	6	0	0	18	0	0	17	0	0
Florida	166	0	1	27	0	1	57	0	0	82	0	0
S. Carolina	242	1	0	30	0	0	128	1	0	84	0	0
Nebraska	277	0	1	34	0	0	146	0	1	97	0	0
Tennessee	103	0	0	18	0	0	41	0	0	44	0	0
Kentucky	112	2	0	11	1	0	59	0	0	42	1	0
Pennsylvania	228	3	0	23	1	0	138	1	0	67	1	0
New York State	1107	7	4	131	6	0	569	1	3	407	0	1
Maryland	118	0	2	23	0	0	47	0	2	48	0	0
Michigan	377	2	0	30	2	0	162	0	0	185	0	0
Total	10,624	39	32	1481	27	7	5859	8	19	3284	4	6

relationship of tonsillectomy to poliomyelitis merely an academic one. Until control or prevention is certain, the question whether recent tonsillectomy heightens the dangers of contracting poliomyelitis is of acute interest to the medical profession and to the public alike, and means must be taken to ascertain the true relationship.

TABLE III.

Distribution by Types of Involvement: Number and Per Cent.

Year 1946		Cases Preceded by T & A		Cases Preceded by Other Ops.	
Type	Total Cases	No.	%	No.	%
Bulbar	382	18	4.7	9	2.4
Spinal	1292	24	1.9	11	0.8
Mild	616	14	2.3	6	1.0
Total	2290	56	2.5	26	1.1
Year 1947					
Bulbar	509	6	1.2	16	3.2
Spinal	2230	10	0.5	45	2.0
Mild	1592	8	0.5	20	1.3
Total	4331	24	0.55	81	1.9
Year 1948					
Bulbar	1481	27	1.7	7	0.5
Spinal	5859	8	0.13	19	0.32
Mild	3284	4	0.12	6	0.18
Total	10624	39	0.37	32	0.3

Since 1946, the writer, with the cooperation of otolaryngologists throughout the country, has been compiling accurate statistics to determine whether a causal relationship exists

between tonsillectomies and poliomyelitis. The surveys conducted in 1946 and 1947 did not justify the conclusion that a

TABLE IV.

Distribution by Age, Number and Per Cent—Preceded by T & A's and Other Operations.

Age	Total Cases	Cases Preceded by T & A		Cases Preceded by Other Ops.	
		No.	%	No.	%
Year 1946					
0-5	658	16	2.4	2	0.3
6-10	807	35	4.3	10	1.2
11-15	484	4	0.8	3	0.6
16 and over	527	7	1.3	12	2.2
Total	2476	62	2.5	27	1.1
Year 1947					
0-5	1167	4	0.3	25	2.2
6-10	1236	15	1.2	18	1.5
11-15	914	3	0.3	10	1.1
16 and over	1014	2	0.2	28	2.7
Total	4331	24	0.5	81	1.9
Year 1948					
0-5	4276	19	0.44	8	0.17
6-10	2594	17	0.61	7	0.27
11-15	1454	1	0.07	6	0.41
16 and over	2300	2	0.09	11	0.47
Total	10624	39	0.37	32	0.3

causal relationship existed. Out of 2,290 poliomyelitis cases tabulated in 1946, 56, or 2.5 per cent, gave histories of recent

tonsillectomies. In the following year (1947), out of 4,331 cases reported, 24, or 0.55 per cent, had had previous tonsillectomies.

TABLE V.

Bulbar Cases Following Tonsillectomy.

Locality	Age	Number of Days Following T & A
Louisiana	7	15
South Dakota	5	20
North Carolina	6	16
Kansas	7	1
Ohio	7	26
Delaware	5	21
Kentucky	5	10
Utah	5	5
South Dakota	4	21
Pennsylvania	5	9
Delaware	6	21
Arkansas	5	4
Michigan	5	8
New Jersey	5	21
New York	12	21
Delaware	17	8
Michigan	10	14
New York	6	11
South Dakota	9	14
New York	3	18
North Carolina	6	7
New York	4	21
Louisiana	8	11
New York	4	8
South Dakota	5	14
New York	4	21
Colorado	1	18

As reported in 1946 and 1947, the evidence of the surveys was not sufficient to permit drawing a definite conclusion whether or not a causal relationship existed between tonsillectomies and poliomyelitis. The results were directly at

TABLE VI.

Deaths from Poliomyelitis.

Age Group	Cases of Poliomyelitis	Number in Which Death Resulted	Case Fatality Rate
Year 1946			
0-5	658	23	3.5
6-10	807	27	3.3
11-15	711	40	5.6
16 and over	300	30	10.0
Total	2,476	120	4.8
Year 1947			
0-5	1,167	17	1.5
6-10	1,236	17	1.5
11-15	914	20	2.2
16 and over	1,014	40	4.0
Total	4,331	94	2.2
Year 1948			
0-5	4,276	158	3.7
6-10	2,594	113	4.3
11-15	1,454	95	6.5
16 and over	2,300	207	9.0
Total	10,624	573	5.4

variance with the freely expressed belief of certain authorities that recent tonsillectomies predisposed to a high incidence of poliomyelitis, a belief based for the most part on experimental evidence and on limited clinical surveys.

When reporting the 1947 survey, the writer proposed a new approach to the problem and one that might well provide a conclusive answer. Instead of obtaining, through state health departments and private physicians and surgeons, the

TABLE VII.

Bulbar Type of Poliomyelitis.

Year 1946	
Total number cases polio	2,476
Total number cases—bulbar type	382 or 15.4%
Bulbar cases following T & A	18 or 4.7%
Bulbar cases following other operations	9 or 2.4%
Bulbar cases following no operations	355 or 92.9%
Year 1947	
Total number cases polio	4,331
Total number cases—bulbar type	509 or 11.6%
Bulbar cases following T & A	6 or 1.2%
Bulbar cases following other operations	16 or 3.2%
Bulbar cases following no operations	487 or 95.6%
Year 1948	
Total number cases polio	10,624
Total number cases—bulbar type	1,481 or 14%
Bulbar cases following T & A	27 or 1.8%
Bulbar cases following other operations	7 or 0.5%
Bulbar cases following no operations	1,447 or 97.9%

records of poliomyelitis cases which had already occurred and then searching their histories for evidence of previous recent tonsillectomies, it was proposed to set up a study which would answer directly the pertinent question — "are children who

have been tonsillectomized during the summer months more likely to contract poliomyelitis than nontonsillectomized children of the general child population?"

TABLE VIII.

Diseases and Accidents Preceding Onset of Poliomyelitis.

Dog bite	Active rheumatic fever
Conjunctivitis	Tetanus injection
Epilepsy	Torn nail—thumb injury
Measles	Tooth extraction
Inguinal hernia repair—hydrocele	Impetigo
Incision and drainage—rectal fistula	Pneumonia
Cleft palate repair	Harelip repair
Rib resection	Falls
Broken foot (cast)	Lacerations—hand and scalp
Miscarriage	Injuries—nose, back and hand
Strained back	Diabetes
Infected foot	Streptococcus throat
Pregnancy	Immunization injection
Herniotomy	Radium treatment—nasopharynx
Tonsillectomy and adenoidectomy	Pleurisy
Brain abscess	Chicken pox
Appendectomy	Mumps
Auto accident with lacerations	Croup
Extra uterine pregnancy	Sulfa and penicillin therapy
Peritonsillar abscess	Otitis media

As outlined, the study would follow several thousand children who would ordinarily be tonsillectomized during the months of June, July, August and September. So that varying epidemic characteristics of the disease would be properly balanced, it was planned to select approximately 20 hospitals throughout the United States for cooperation in the study. At the time of admission to the hospital, there would be

attached to the regular chart a special card listing pertinent information regarding age, sex, color, date of tonsillectomy and space for comments for a weekly three-month follow-up study. Following tonsillectomy and the patient's discharge from the hospital, the card would be turned over to special social service workers for follow-up at weekly intervals to determine whether or not poliomyelitis ensued. Such a study, properly supervised and tabulated, would give conclusive evidence whether the incidence of poliomyelitis in recently tonsillectomized children was significantly greater than the normal incidence of the disease in the general child population.

Although strongly urged at the time, this particular study has not yet been undertaken. Financial and organizational problems have thus far prevented its initiation, but there is still hope that the difficulties may be overcome and the study made.

Failing to obtain the necessary support for the above mentioned comparative study, the writer has continued with the original study initiated in 1946 and 1947.

During 1948 the United States suffered an epidemic of poliomyelitis comparable to the most severe in its history. The United States Public Health Service reported a total of 27,894 cases. Continued cooperation from our state chairmen and state health departments resulted in a compilation of statistics from 10,624 of all cases occurring, a percentage of 39. This compared with 2,290 cases studied in 1946, a percentage of eight, and 4,331 in 1947, a percentage of 40.

Of the 10,624 cases on which data were received, 38 had histories of previous tonsillectomies — an incidence of 0.36 per cent. A breakdown of the 10,624 cases revealed that 1,481 had the bulbar type of poliomyelitis. In this bulbar group, 27 were preceded by tonsillectomies — an incidence of 1.7 per cent. Of the 5,859 cases listed as spinal type, eight, or 0.13 per cent, gave histories of tonsillectomies. In the 3,284 cases recorded as "mild," four, or 0.12 per cent, had recent tonsillectomies. All tonsillectomies occurred one to 30 days prior to the onset of poliomyelitis.

TABLE IX.

Tonsillectomies—Year 1948.

State	Cases Reported	Contracted Bulbar Polio
New York	3,511	0
Delaware	2,765	3
Canada	2,064	0
Illinois	1,868	2
Pennsylvania	1,403	0
Massachusetts	1,259	0
North Carolina	1,231	0
New Jersey	671	0
Tennessee	500	0
Ohio	379	0
Maine	362	0
Michigan	340	0
South Carolina	333	0
Indiana	266	0
Connecticut	220	0
Wisconsin	210	0
Rhode Island	200	0
Texas	180	0
Washington, D. C.	102	0
Colorado	100	0
Kansas	96	0
Washington	88	0
Oregon	81	0
California	77	0
Hawaii	69	0
Missouri	21	0
Total	18,396	5

In the 10,624 total cases in the survey, 32, or 0.3 per cent, were preceded by operations other than tonsillectomy (appendectomy, herniotomy, etc.). In the 1947 survey, 81, or 1.9 per cent, of the 4,331 cases were preceded by operations other than tonsillectomy; and in 1946, 26, or 1.1 per cent, of the 2,290 cases were preceded by similar "other operations."

Keeping in mind the warning that during epidemics children who are tonsillectomized have an increased danger especially to bulbar poliomyelitis, it is interesting to observe that in the 1946 series of cases, out of a total of 382 bulbar cases,

TABLE X.

Tonsillectomies—1937 to 1949.

Reported at the Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., St. Louis, April 26, 1947, tonsillectomies performed at the Manhattan Eye, Ear and Throat Hospital during the summer months of 1937, 1939, 1941, 1942, 1943, 1944, 1945	11,204
Reported in 1947 (National Survey)	5,439
Reported in 1948 (National Survey)	18,396
	35,039
From this total of 35,039 cases of tonsillectomies which were followed for a two-month postoperative period, only five contracted bulbar poliomyelitis	0.014%

355, or 92.9 per cent, occurred without any preceding operation. In the 1947 group studied, 509 were of the bulbar type, of which 487, or 95.6 per cent, occurred without any recorded history of recent tonsillectomies or other operative procedures; in the year 1948, 1,481 bulbar cases occurred in the group under survey. Of these bulbar cases, 1,450, or 97.9 per cent, occurred without history of recent operations.

CONCLUSIONS.

After 10 years' study of this subject, following over 17,000 poliomyelitis cases and 35,000 tonsillectomy cases, I am still of the same opinion that I was one year ago, namely that no definite causal relationship between tonsillectomy and poliomyelitis has been established; therefore, I do not believe that tonsillectomy should be postponed indefinitely simply because the summer months are the months during which poliomyelitis is prevalent. If, however, there is a distinct rise in the poliomyelitis rate, bordering on epidemic proportions, in any community, all elective operations should be postponed.

Until evidence of a conclusive nature is forthcoming, the surgeon should decide whether or not to perform tonsillectomies during the summer months and whether the dangers of delaying the operation are greater than the still undetermined risk of increasing susceptibility to poliomyelitis.

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TWO-ROOM AUDIOMETRY SETUP FOR THE OTOLOGIST'S OFFICE.*

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Since most of the existing clinical tests for the determination of auditory acuity are subjective, it is essential that the individual to be tested be placed in an environment free of excessive extraneous visual and auditory distractions. It is axiomatic during pure tone audiometry that the patient be placed so that the turning of dials and switches of the audiometer will not visually influence his responses. Likewise, when speech reception audiometry is being performed, all equipment such as racks, turntables, amplifiers and microphones should be placed so as not to distract visually the person being tested; further, the room or rooms for clinical use should be sound treated but not necessarily "dead."

During the existence of the hearing clinic at Borden General Hospital, Chickasha, Okla.,[1] approximately 5,000 patients were treated. This meant that several thousand audiograms were recorded. Fig. 1 shows the routine positioning of a patient at that hearing center during pure tone audiometric testing assuring a minimum of visual and auditory distractions. Speech reception testing was carried out in a two-room setup either by the use of headphones or in the free field. Pure tone audiometry was also used in the two-room setup for some of the hearing aid selections as a free-field measure of unaided auditory acuity. The results compared favorably in most cases with routine monaural pure tone audiometry. During that period of time the possibilities of a two-room

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Figure 1. The position of a patient during pure tone monaural audiometry at the Hearing Clinic, Borden General Hospital.

setup for pure tone and speech reception audiometry for the otologist's office were discussed.[2] It was the foregone conclusion that speech reception testing would be satisfactory providing the necessary equipment and personnel were available. Since there was no precedent for pure tone monaural audiometry in a two-room setup, the only way to determine its feasibility was to establish such a unit. A search of the literature made for clues as to what such a setup should include brought no results.[3]

Early in 1948, in private practice, existing office space consisting of two small rooms, one of which was already sound treated, became available for pure tone monaural audiometry (see Figs. 2 to 4). This project has been in the process of

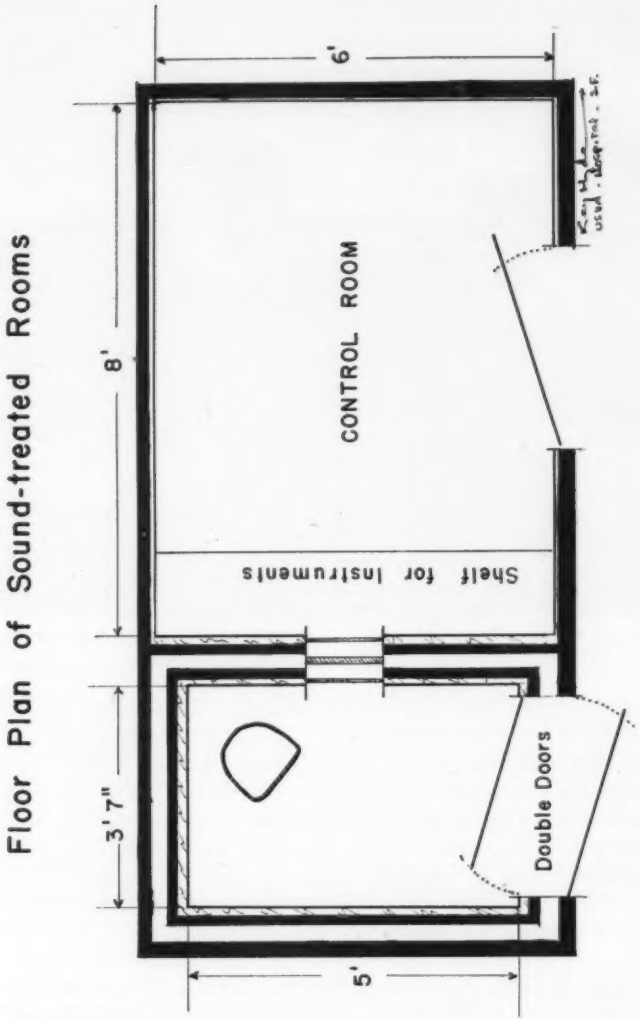

Fig. 2. The floor plan of office space available for sound-treated and control rooms.

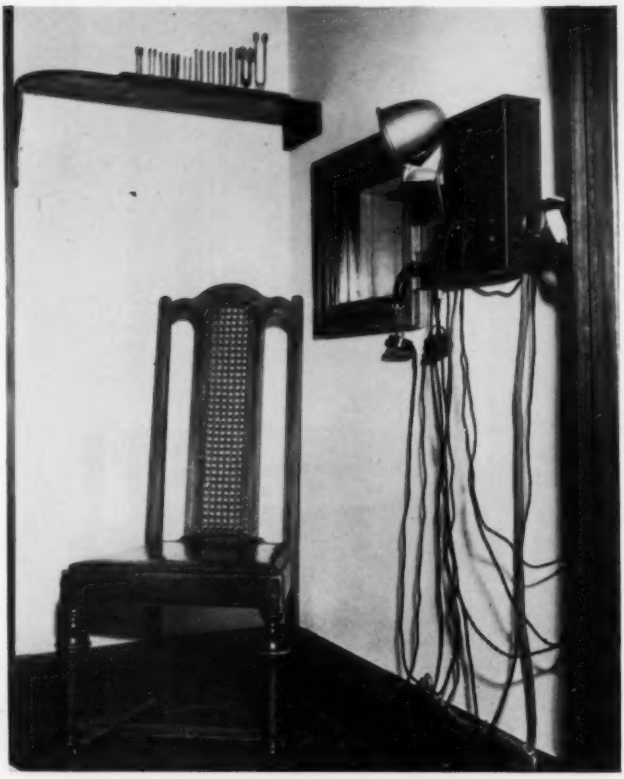

Fig. 3. Interior of sound-treated room with electrical-audio equipment. Note the loudspeaker of the intercommunication system and the receivers.

development for 11 months. It is not being presented today with the thought of revolutionizing pure tone audiometric technique but simply as a natural evolutionary step, based on Army experiences, toward the improvement of testing accuracy. The advantages and disadvantages of such a setup will be pointed out.

Fig. 4. Control room. At this stage of development, November, 1948, the speech production apparatus had not been added. In the panel box, note binaural and monaural switching dial which, associated with the audiometer's microphone or pure tone circuits, is used for malingering tests. The patch cords are 36 inches in length and are used to connect the audiometer's outputs with the jacks in the panel box. The press-to-talk switch can be seen in the upper right hand corner of the panel box. The position of the patient within the sound-treated room is shown.

Physical Equipment:

The dimensions of the sound-treated room are given in Fig. 2. The ambient noise level within this room is consider-

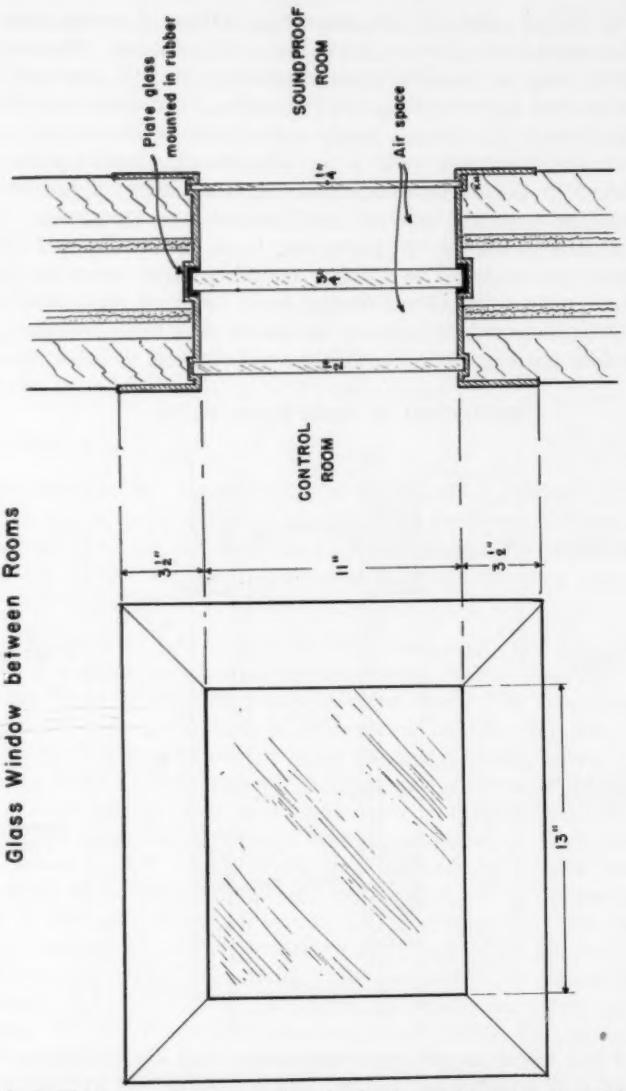

Fig. 5. This type of window construction has been satisfactory for clinical purposes as there is a minimal sound leakage through or about it.

ably below that of the remaining office. A room next to the sound-treated room serves as a control room. The control room may be smaller than diagramed and if the ambient noise level is low within this room also, "live voice" testing is facilitated. The door arrangements to these rooms were such that they did not need to be altered. A glass window, as shown in Fig. 5, was constructed and placed at a convenient level between the control and the sound-treated room. The dimensions of this window are 11 x 13 inches and allow ample visibility. The window contains three panes of plate glass measuring three-fourths inch, one-half inch and one-fourth inch, respectively, in thickness. The three-fourths inch middle pane is mounted within a rubber seal. The other two

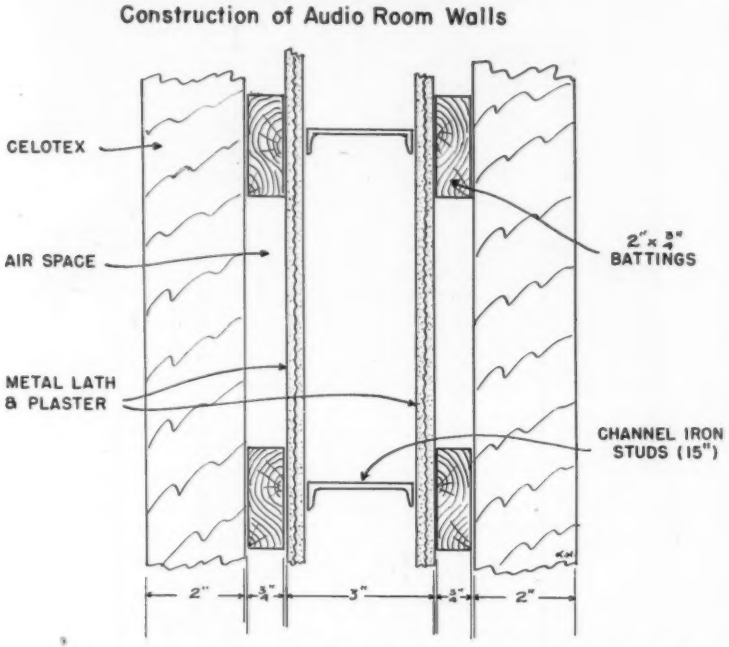

Fig. 6. A wall section of the sound-treated room seen from above. Note the overall thickness of the wall. Such a thickness insures ample air space between the panes of glass in the window.

are mounted on either side in grooves in a wooden frame. An air space is between each pane of glass so that sound attenuation is obtained. For clinical purposes, the construction of the window appears adequate. The wall of the sound-treated room wherein this window was placed is some eight and one-half inches thick, as shown in Fig. 6. The window frame was placed solidly within this wall and was packed about its frame with insulating rock wool. This further insured minimal sound leakage. In the control room a shelf for electrical-audio equipment was constructed at a convenient working level with relation to the window. It is beyond the scope of this paper to go into the details of the sound treatment of this room, but it may be stated that the same construction as shown in Fig. 6 is to be found in the other walls and ceiling.

Electrical Equipment:

Throughout the construction of electrical equipment simplicity was stressed. One of the accepted pure tone audiometers was procured for the source of pure tones. The essential features of the electrical equipment between the two rooms are shown in Fig. 7.

In order that the technician may talk with the patient, there is a press-to-talk microphone circuit. When the subject speaks from within the sound-treated room the examiner hears the patient through a microphone loudspeaker circuit which is always open except when the press-to-talk circuit is in use. Most hard-of-hearing patients and even some moderately deaf patients can hear satisfactorily through this system. Ten pairs of cables run between the control room and the sound-treated room. This large number of cables was installed so that flexibility could be maintained. As noted in Fig. 7, one pair of cables serves for air conduction, one for bone conduction, one for masking, and two pairs serve for binaural and monaural testing. The audiometer is connected through these cables by the means of telephone plugs and jacks. The receivers and bone oscillator within the sound-treated room have been connected with the terminal end of the cables in the same manner. It has been found that the

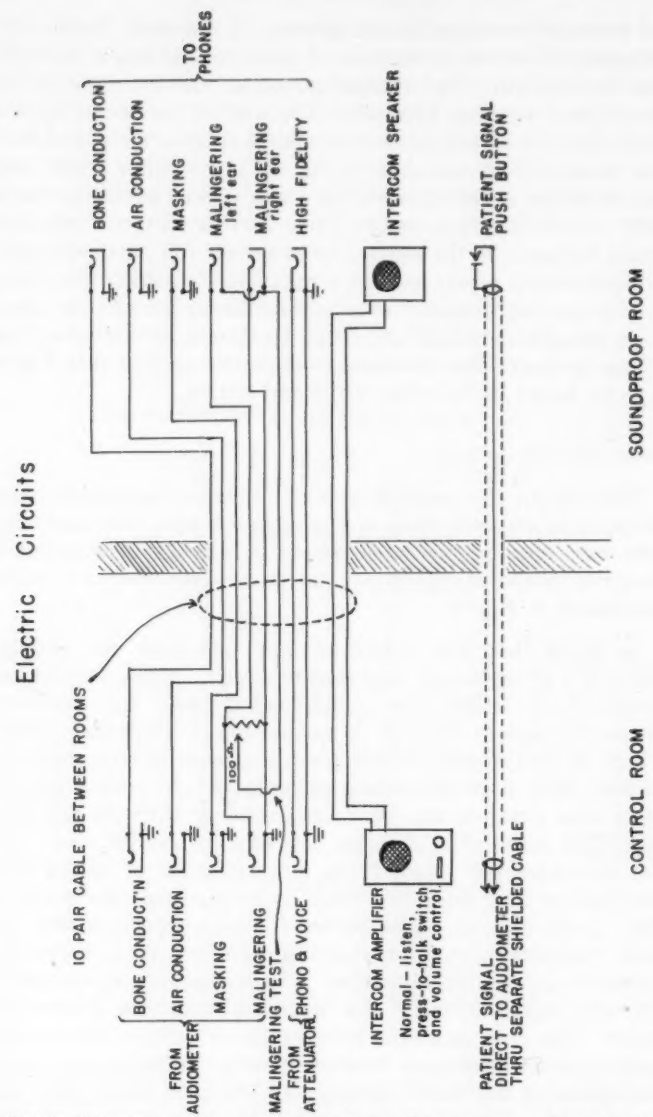

Fig. 7. Only seven pairs of wires between the rooms are shown in the illustration. The other three pairs are omitted to clarify the picture; these circuits have been installed for additional electrical equipment. With proper shielding of the wires between rooms the lone cable for the patient's signal would be unnecessary.

calibration of the audiometer is the same through this additional circuit as when calibrated in the routine manner. The patient's signal light is connected by a different circuit, since none of the 10 pairs of cables between the two rooms was sufficiently insulated to eliminate static. A switching device for monaural and binaural malingering tests has been incorporated in the panel box of the control room. This circuit has proved to be extremely useful, as will be shown later. The electrical equipment needed for pure tone audiometry in this two-room setup, in addition to the equipment that comes with the commercial audiometer, are the several pairs of cables, an intercommunicating system, patch cords and the cable for the patient's signal.

Within the past month electrical-audio equipment has been installed for speech reception audiometry (see Figs. 8 and 9). The equipment is essentially of the type recommended by Hudgins, *et al.*,[4] with additional outlets for "live voice" and a noise generator. Since this equipment has not been installed long enough for a thorough clinical test, its details and performance will not be discussed at this time; however, as stated previously, the two-room setup has proved its value in speech reception audiometry.

Standard Operating Procedures:

The two-room set up such as described does not essentially alter the technique of pure tone monaural audiometry. The patient is placed within the sound-treated room at such an angle that his face is partially or fully in view of the operator (see Fig. 4). The operator instructs the patient concerning the testing while placing the patient in the sound-treated room. The operator then goes to the control room and carries out the pure tone air and bone conduction audiometry. The patient is further instructed across the intercommunication system if the occasion arises. Three methods are open for the patient's signaling; namely, by the use of the "patient's electrical signal," by the patient stating "on-off" or by the "up-down" method of the index finger. In any instance, the signal is readily conveyed to the operator. The "on-off" method is

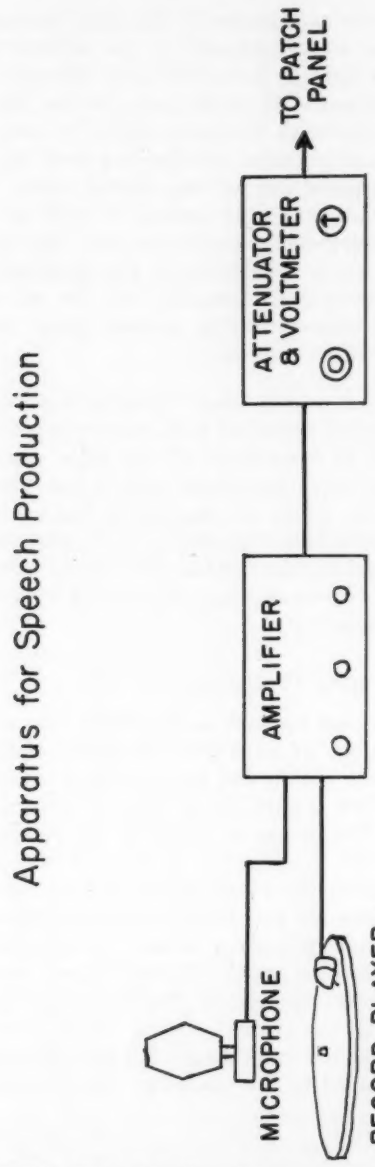

Fig. 8. The essential pieces of equipment necessary for speech reception testing. The headphones are not shown since they are in the sound-treated room.

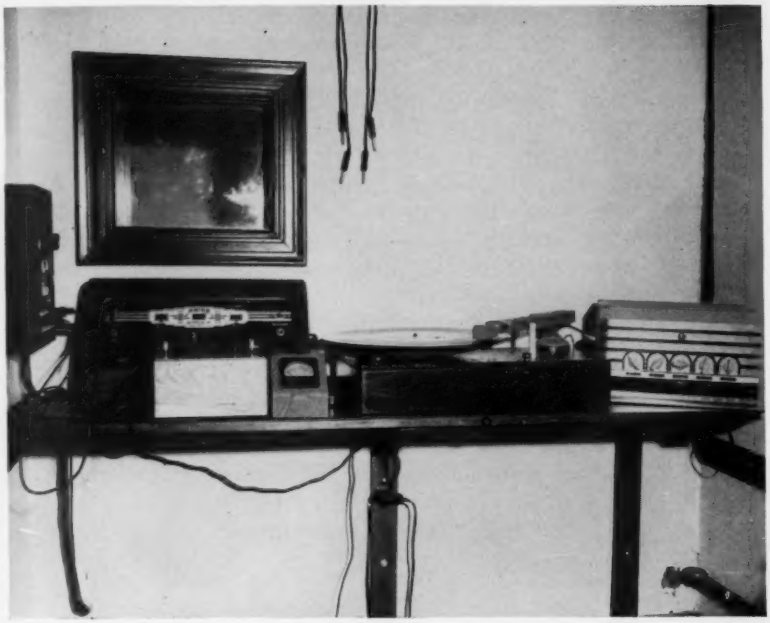

Fig. 9. The equipment being installed for the testing of auditory acuity by speech reception. The various electrical components are to be "racked" with an appropriate control panel.

used routinely for bone conduction testing because of routine masking, and when one ear is masked in air conduction testing. For some children it has been found that testing is more expeditiously carried out by placing one of the parents in the sound-treated room with the child. With those patients, children as well as adults, who are difficult to test, it has been found advantageous to place one observer in the sound-treated room with the patient while the operator remains in the control room. Routinely, younger children are asked to face the window so that their facial expressions can be watched.

By the use of the audiometer's microphone circuit, monaural and binaural articulation testing to detect malingering has been found to be much more reliable in the two-room setup.

The binaural headphones can be removed from the headband and used for the Stenger test, using any desired frequency and intensity. The Lombard test can be given monaurally or binaurally by introducing noise (Bárány noise box) through the microphone circuit in the control room. The audiometer's masking circuit may also be used for this test. As the patient reads, the inflection, loudness and softness of the voice can be interpreted on the intercommunication system. Likewise, in further testing for malingering, conversations can be carried on through the microphone circuit either monaurally or binaurally and even some trained listeners may be baffled by switching test material from ear to ear.

The results of the tests are carefully recorded in a so-called log book.[5] The log book contains the date of the test, the name of the patients, type of tests, and comments regarding the accuracy of the tests. Results of calibration of equipment, and changes in equipment are carefully recorded. These data are essential if the results of hearing tests are to be considered reliable and comparable from month to month and year to year.

Comments:

Over 600 pure tone monaural audiometry hearing tests have been carried out in this two-room setup. The patients have presented all types and degrees of hearing losses. The youngest children to be tested have been approximately four to five years of age. It appears that pure tone audiometry testing in a two-room setup has been entirely satisfactory in about 96 per cent of the cases. In fact, many of the patients who have been tested, both in the routine manner and the new setup, have commented that the new setup is much more desirable. Their reasons vary from greater accuracy of this method of testing and fewer distractions to simple statements of personal preference. Since the testing of hearing is subjective, the patient's comments are of some significance.

The equipment is simple and easy to operate by the technician. The average technician can master this technique of testing as quickly as routine audiometry. Our technician who

has been operating this equipment has had no special training except as obtained in routine clinical work and by doctor's instruction.

The equipment is durable and can be used long hours daily if necessary. The electrical equipment has not been excessively expensive to install. Calibration of the audiometer even with the additional circuits has been constant. Most medico-dental buildings contain X-ray equipment, diathermy equipment, coagulating machines, etc., so some arrangement for the shielding of electrical circuits must be made. This is a problem which can usually be solved without difficulty.

The disadvantage of such a two-room setup for pure tone audiometry is the length of time required for the testing; however, the accuracy of the results obtained compensates for the expenditure of time. It has also been suggested that the equipment is complicated. In practice, this has been disproved. This electrical-audio equipment, including the two rooms as now used, is not satisfactory for free-field work, but with modifications and remodeling it could be made to be so. Some operators desire to watch facial expressions of the patient and they conclude that audiometry should be done in one room. With the two-room setup and the window between, the patient can be placed in a position where facial expressions can be watched if so desired. If, after placing an observer in the sound-treated room with a child who is difficult to test and still satisfactory results are not obtained, then it is permissible for the technician to move with the audiometer into the sound-treated room. Even by testing such children in the routine manner the results are still sometimes questioned as to reliability. In our experience very few children had to be tested in this manner. Dix and Hallpike[6] have attempted to solve this problem by developing the peep-show for the pure tone testing of young children.

Conclusion:

As experience with the two-room setup for pure tone monaural audiometry has accumulated, it appears that its advantages are: less distraction for patient, better acceptance of

test by patient, greater ease for technician, more accuracy in malingering tests, and greater flexibility. Since speech reception techniques are fast becoming an integral part of hearing tests in the otologist's office, and since it is an accepted fact that these tests are ideally carried out in the two-room setup, it then follows that it is a natural evolutionary step in audiometric technique that pure tone monaural audiometry be incorporated in the same two-room setup. Data obtained in one of the Army's hearing centers gave impetus for the present undertaking.

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384 Post Street.

OTOLARYNGOLOGY: WHAT ARE ITS RESTRICTIONS AND WHERE ARE ITS BORDERLINES?*

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Now, as never before, it is indeed timely for the otolaryngologist to determine his status as a surgical specialist. The reason for this is the uncertainty which has betaken those already entrenched in the specialty, and also those contemplating preparation to enter the field. While there may be individual experiences to the contrary, existing conditions present notable causes for alarm. A militant attitude on the part of leaders in this specialty is called for, lest the "vanishing age of otolaryngology" becomes a reality to record for posterity.

A knowledge of the historical factors which permitted otolaryngology to attain its high place in medicine and surgery is important, if we are to appreciate the changes which have already taken place and those which loom as possibilities. We would be remiss if we did not remember those of our predecessors who made substantial contributions to the develment of otolaryngology. Now we are confronted with relinquishing rights to the domains for which our predecessors definitely established priority.

History begins to repeat itself. When the long-robed (the surgeons) and the short-robed (the barbers) fought it out in the early thirteen hundreds, decadent epochs followed in the

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wake of the many controversies. Stalemates and petty bickerings retarded progress and leaders in medicine referred to otolaryngology as quackery. In so doing, they were actually responsible for aiding charlatan practices.

Clendening has remarked: "The plight of a patient with an eye or ear disease up to the end of the eighteenth century was pitiable to the extreme." Actions, which must in all candor be recognized as counterparts of the bigoted thinking of the previous era, are beginning to manifest themselves in the twentieth century. The so-called "gold era of otolaryngology" is threatened with arbitrary restrictions which could eventuate in the final extinction of the specialty.

This presentation should not carry with it the possible stigma of the cry, "wolf, wolf." It is well then to make it clear that what I have to say is based on actual experience in the otolaryngological department of a large universtiy. Rapid developments have made it difficult to maintain the moral and scientific integrity of the ear, nose and throat fields as a separate unit. It actually poses the problem of survival, while administrative departments, concerned only with peaceful settlement of age-old disputes and the general surgeon's accusation of expansionistic tendencies, try to settle the differences. I wish to record my own defense of otolaryngology as a head and neck specialty in medical educational programs. My interest is actuated by the fact that this is not a local problem. On the contrary, it concerns the worldwide acceptance of what reliably constitutes the specialty of otolaryngology. I am not concerned whether we emerge victorious in this controversy, but rather that the otolaryngologist and the general surgeon reach an amicable settlement. Obviously, this would be for the good of medicine and surgery in general.

Let us consider the situation in one of our largest medical schools. The discussion concerned the dean of this medical school, the head of the department of surgery and the head of otolaryngology:

The dean stated that the purpose of the conference was to try to settle those departmental difficulties wherein there

seemed to be overlapping of activities. He made it clear, however, that his own opinion was that recognition should be based upon the training, experience and ability of persons engaged in any endeavor.

The head of surgery stated that otolaryngology, impelled by the restrictions of operative intervention caused by chemotherapeutic and antibiotic drugs, had felt the need suddenly to expand its activities by invading the field of general surgery. He included plastic surgery and neoplasms with neck surgery as the main areas of expansion. Furthermore, he stated that men trained in otolaryngology today would discontinue the practice of otolaryngology and represent themselves as specialists in plastic surgery and even in tumor surgery. He admitted the lack of well trained men in this field among the general surgeons and stated that he had sent one of the members of his department to be trained in neck surgery.

The head of otolaryngology called attention to the lack of knowledge of the historical phases of otolaryngology on the surgeon's part, and more particularly of the past record of the development of the department in the medical school. The same disciplines of tumor surgery and maxillofacial surgery were in vogue when the medical school hospital opened its doors. Members of the department of otolaryngology were leaders in contributions to the head and neck literature, and postgraduate students at the university were taught these subjects for the past two decades.

It was pointed out that 1,700 hours of basic training in otolaryngology in this same medical school included approximately 600 hours or more in anatomy and morphology of the head and neck. Did the general surgeon assume prior rights on the basis of equal training? By what authority did the general surgeon assume prior rights for claiming plastic (maxillofacial) surgery of the head and neck? Were not the original leaders in the field (Gordon New, Warren Davis and Ferris Smith, to mention a few) otolaryngologists? He reminded his colleagues that in the majority of schools and

institutions of repute, plastic (maxillofacial) surgery is under the overall administration of the department of otolaryngology; in a few it is a separate department, and in others it is embraced in the dental school curriculum.

The head of otolaryngology brought out in this conference the fact that 55 per cent of all neoplasms encountered in the tumor clinic of this medical school are of the head and neck. He stated that most tumors (malignant) of the neck have their source in the pharynx or nasopharynx. Is not the otolaryngologist, by training and experience, the logical person to treat these neoplasms? Is the gynecologist, the orthopedist, the neurosurgeon or the dermatologist expected to relinquish tumors in their respective anatomic fields to the general surgeon? He certinly is not, so why should the otolaryngologist?

The general surgeon will, without reluctance, allow that the otolaryngologist perform a laryngectomy, an admittedly formidable procedure. Yet the general surgeon questions the right of the otolaryngologist to operate a thyroglossal duct cyst which traverses the hyoid bone, or a pharyngeal diverticulum, for which the otolaryngologist has developed a technique that permits a one-stage procedure.

The otolaryngologist, as bronchoesophagologist, has contributed largely to the solution of medical and surgical problems of the chest. He has trained chest surgeons and anesthesiologists in the arts of bronchoscopy. Yet he has stood by meekly while the same forces, who have invaded this field, are the ones who cry out and seek to restrict further and isolate the otolaryngologist.

It was brought out that the otolaryngological department in this medical school has a teaching program and, therefore, a responsibility for complete training of its students. The Board of Otolaryngology requires of its candidates that they have a comprehensive knowledge of neck surgery and plastic (maxillofacial) surgery, in addition to the requirements of basic and residency training; therefore, a department of otolaryngology would be remiss in its function if it did not include these disciplines. A knowledge of audiology, which includes speech

and hearing, is also required of the candidate for certification. By the same token, is the otolaryngologist to be denied this right because such subjects are given in courses of education. speech, journalism, and the like, in some other colleges? Should the otolaryngologist be consistently denied the right to use short-wave therapy or coagulating currents because, after all, that is physical medicine? Should the otolaryngologist, or the neurosurgeon, be denied the right to perform fundoscopy or graph fields of vision because these tests fundamentally belong in the domain of the ophthalmologist?

Otolaryngologists stand by while the plastic surgeon, sometimes in the guise of the oral surgeon, takes his cut at a cleft palate, a maxillary sinus, a fractured nose, etc., frequently performed without good vision, only by palpation, and without the fundamentals or basic knowledge of the anatomy of these parts.

As the conference continued, the head of otolaryngology stated further that a lack of a democratic attitude in medical education would be evident if dominance is to be established purely on sharply defined anatomical grounds, where, for example, the general surgeon would permit the otolaryngologist access to those tumors situated posterior to the posterior pillar of the pharynx. By virtue of his training, is the general surgeon entitled to the special privilege of dealing with pathologic processes which involve these anatomic sites?

It seemed to the otolaryngologist that if this problem was to be considered from an administrative point of view, a qualified plastic (maxillofacial) surgeon with otolaryngological training, the time to devote to a busy otolaryngological service and to 100 hours of teaching otolaryngological postgraduate students and residents, should be appointed to the department of otolaryngology. It does not seem rational that this man should have his appointment to the department of surgery. Other departments have appointees who have their basic qualifications in entirely different but, nevertheless, related fields. The time of the plastic surgeon who works in the

head and neck division is not dissipated in unrelated areas. His otolaryngological associations and activities give him a background no other plastic surgeon possesses.

In answer to the head of surgery, the otolaryngologist proceeded to say that the postgraduate students and then the residents in otolaryngology receive a broad training. As they do not know where their future activities may lead them, they must be provided with a thorough background. Contact with specialists in time of national emergency has shown a glaring lack of a comprehensive training. The fear expressed by the head of surgery that these men are going out into practice and represent themselves as tumor specialists or plastic surgeons is not supported by experience. Bronchoesophagologists have become so only by special training in their field and only after they have completed their basic and residency training. The same can be said in the other more specialized fields where residents in otolaryngology have gone further in their training to qualify themselves by virtue of special residencies and fellowships.

The otolaryngologist made a plea for autonomy to allow for the individual department's needs. He expressed the view that a department of otolaryngology under the administrative control of a department of surgery will be revealed as a department sterile of progress and stifled in its growth. To be constructively helpful, he offered to the department of surgery training for their residents in the basic subjects of the specialty of otolaryngology. He asked of surgery a similar cooperation in the training of prospective otolaryngological residents in the basic principles of general surgery. The problem, he felt, must resolve itself on the basis of training and experience. Narrow-mindedness has no place in its consideration. The head of otolaryngology believed that the apparent differences implied in this conference were to be construed as a problem having national, if not international, significance. He was concerned lest his medical college repeat the mistakes of the past, when personal and political differences and bigotry encouraged the rise of charlatans and quacks. He desired that progress in medicine and surgery

be enhanced by justifiable accomplishments! So did the head of otolaryngology conclude the discussion in hopes that his contentions would be supported.

The initial conference resulted in a group of proposals submitted by the dean, specifically concerned with plastic surgery. They follow:

1. To set up a plastic surgery service — not a department.
2. To be under the general charge of the department of surgery.
3. The chief of service to be selected and appointed by head of surgery after consultation with heads of other surgical branches, departments (otolaryngology, ophthalmology, orthopedics, neurosurgery).
4. That this chief need not always be from the department of surgery.
5. That members of the faculty and staff appointed to this service are to serve under the general direction and supervision of the chief.
6. That qualified physicians from all related departments are to be eligible in numbers to be determined by the medical director upon consultation with heads of departments concerned.
7. That residents from all services concerned are to rotate through the service in a manner to be determined, but without the necessity that all residents must so rotate, and with the understanding that a certain resident from any proper service be given such service as to qualify him as a plastic surgeon, as far as a residency is concerned. It is recognized that in this training service emphasis may be placed on certain types of plastic surgery, *i.e.*, head and neck, general, etc., but only on the basis of a sound general training. It is expected that the number of such residencies willl never be large, but will be so allocated as to give equable opportunity. If possible, a progressive, pyramidal type of service should be provided, partly to permit alternation of appointments.
8. That clinical facilities, *i.e.*, beds, are to be provided on the basis of a pooling of resources to provide such a service. The dean further recommended that this include the facilities at the affiliated ear, nose and throat hospital.
9. That the service and this arrangement be correlated with certain aspects of the tumor clinic, because of the important relation of cancer to plastic surgery, particularly in the area about the head and neck.

In conferences with members of his department it was apparent to the head of otolaryngology that in proposals from one to five, dominance of general surgery over surgery in a specialized area was to be administratively supported. This

was disquieting, because it is historically difficult to defend such extensions of authority. While, on the one hand, it was believed that there was some administrative reason for this integration, it seemed to them more likely that it was the result of a personal aggression and personal pressure. In proposals six through eight, there was reflected a better spirit of cooperation and encouragement of interests which are important to the specialty of otolaryngology. Proposal nine has more to it than meets the eye, for the next attack might be to restrict the otolaryngologist in his efforts to deal with tumors of the head and neck. Further comment on this particular point will be discussed later in this presentation.

It was not evident what the disadvantage would be either to the patient or to the program of instruction to have the plastic surgery specialty continue to grow in its most congenial environment. Certainly, in the case of maxillofacial surgery, it has been demonstrated in many institutions that distinguished surgery and teaching it provided in the department which gives the most immediate stimulation through identification with problems most characteristic of its interests. Cleft palate is a case in point. It may well be repeated that some of the best maxillofacial surgery in the field of cleft palate is provided for in a wide variety of professional environments. Some is done in otolaryngology; some is done in dentistry; and some has been accomplished by plastic surgeons who function in a general surgical structure. This same institution is now embarking upon a national program in cleft palate training. It would be essential that whoever was responsible for the plastic work in the area would be sufficiently free to provide the necessary teaching time. Experience in this area shows that men now working in the field of general surgery and who are interested in plastic work do not find themselves able or willing to contribute substantial portions of their time for this purpose. From an educational standpoint, this does not seem to be sound.

The proposals that the chief of the designated plastic surgery service should be "selected and appointed by the head of surgery" places the total direction and conduct of plastic sur-

gery services in the hands of one department. Here, assumption is that this general administrator would be sympathetic to all branches of application of plastic surgery. Evaluated honestly, this does not seem to be the case in this and other institutions.

It was not possible to determine from the proposals what the major evil consists of; nor was it clear for what purpose the proposals were designed. On the face of the present issue, it appeared that the charge was merely one of "open encroachment." It may be possible to demonstrate that the present differentiated programs among departments produce an inferior service to the patient and poor teaching opportunity, but this did not seem to be the case in this particular medical school. The members of the department of otolaryngology were unable to determine from the discussion of the initial conference what complaints of major character had been presented against the present system by the head of surgery, nor was it clear what a revision of the system would achieve by putting it under general surgery. These, it seemed, were the major questions to be considered. It would appear that one of the most important encouragements to further developments in the plastic surgery field was to be derived from the problems characteristic of the specialty. There is reason to defend the thesis that plastic surgery is, at best, an expression of certain specialties, rather than being a specialty in itself.

In proposal nine, dealing with the tumor clinic, the correlation and cooperation with the tumor service appear quite simple and feasible. This, however, is not the case. It forecasts other disagreeable experiences should tumor surgery come into a similar administrative orbit. Ever since the tumor service began at this university hospital, the department of otolaryngology has been the sole division attempting close cooperation. The net result has been that general surgery has resected such parts as external ears and noses. Who will dispute the fact that these belong to the otolaryngologist? It is unnecessary to delve into the innumerable instances of a similar nature, reflecting the complete misinterpretation of surgical domain. Whereas, as originally intended, the tumor

clinic was set up as a consultative service, it now has become a competitive organization depriving other departments of needed material. It is pertinent to this proposal that the chaotic state of affairs existing in a Veterans Administration hospital served by this same medical school be examined, because the very plan, as proposed by the dean, has been tried for several years. How ineffectively such a plan functions is contained in the following facts, as drawn up by members of the otolaryngological staff. They might prove of interest generally, *viz.:*

1. The tumor service is actually not a tumor service. It is a head and neck service almost in its entirety, inasmuch as the majority of the lesions occur in the head and neck.

2. There has been no distinction made between otolaryngological tumors and what the surgery department states is general surgery. The general surgeon has arbitrarily asserted that this is his rightful sphere of influence.

3. The otolaryngological residents are better prepared in their knowledge of the neck than the general surgical resident. Good neck surgery requires a complete understanding of the ear, nose and throat in all of its aspects.

4. There is no question whatsoever that the present tumor organization is predicated upon the desire of the general surgeon to keep the ear, nose and throat specialist away from the external surgery.

5. They agree that the otolaryngologist should do laryngectomies of all dimensions, and yet they feel that thyroglossal cyst and pharyngeal diverticulum, etc., are in the sphere of action of the general surgeon. We do not know by what law they arrive at this decision.

6. Attending general surgeons are placed on the tumor service to obtain experience in head and neck surgery. One would expect that they should be there primarily to teach. No experienced otolaryngologist is welcomed as a surgical consultant to the tumor service. This, apparently, is a further attempt to restrict members of the head and neck department and narrow the scope of their work.

7. The tumor service organization, as it presently exists, does not follow the dean's committee directive, which states that the chief of the tumor service is to act in an advisory capacity. Since the tumor service is, in fact, primarily a head and neck tumor service, any man, general surgeon or ear, nose and throat specialist, who is capable of performing head and neck surgery complete, should be in a consulting capacity . It should not be a question of a particular patient belonging to general surgery or the ear, nose and throat. Each consultant of a service should be apportioned a set number of beds with corresponding residents from each service.

8. The otolaryngological residents have been used in the capacity of writing voluminous reports and preparing cases for surgery in which they are not even asked to participate. The otolaryngologists examine the majority of these patients and determine the nature and extent of the lesion. The general surgeons performing the surgery have not participated in the work-up nor are they, by virtue of their training and experience, prepared to do so.

9. The otolaryngological consultant has endeavored to give the general surgical residents opportunities for training, better to prepare themselves for such work as concerns the head and neck tumors. Reciprocal privileges have not been tendered to our residents.

10. The otolaryngological service is the only one which jointly has attempted to work out its surgical problems, whereas all other departments have taken unrestrictedly all cases in their domain and deny infringement of their rights to the tumor service.

In the medical school under discussion notable progress toward a solution of the tumor problem was advanced when the hospital executive committee issued the following directive:

"The intake division will assign new patients to the clinic to which they seem to belong — not to the tumor clinic. For example: a patient with a tumor of the skin will go to dermatology clinic, one with a probable bone tumor will go to orthopedic clinic, etc. After the case has been worked up and before definitive treatment, the patient will be sent to the tumor clinic with a consultation request. The tumor clinic recommendations will not be considered binding upon the doctors who assume responsibility for definitive treatment. After definitive treatment has been completed, the patient will be followed through the tumor clinic."

This constitutes a great step forward, in that it sets up a tumor service as a central registry and follow-up division, serving in a consultative manner, the ultimate disposition and management of tumor patients being left entirely to the various departments. Whether or not the rightful domain of the otolaryngologist will be supported in this plan remains to be seen.

CONCLUDING COMMENT.

In the light of the foregoing remarks, it is fair to ask of ourselves: Is otolaryngology progressing as a specialty? Are we still being considered as the group limited by a few mechanical operative procedures such as tonsil and adenoid and septal resection specialists? Is it not a fact that we are suffering from the errors of omission of some of our predecessors who called upon the general surgeons to tie off large vessels in the neck and complacently sat back while the men of vision in otolaryngology sought to elevate the standards of medical and surgical practice? We cannot assume responsibility for those men who emerged from short-time training periods and represented themselves as specialists; furthermore, we cannot subscribe to the philosophy of those timid otolaryngologists who would call for help because they do not wish to assume total surgical responsibility. We can, however, with justifiable pride, call attention to the fact that as far back as 1916, the American Academy of Ophthalmology and Otolaryngology examined candidates for admission to membership and, in 1924, officially aided in forming the American Board of Otolaryngology. It seems that there are men in otolaryngology who are able and willing to adhere to prescribed practices of elevated standards.

We, in otolaryngology, have not remained static, but have achieved progress by thinking beyond the narrowed confines of cavities. We have primarily been physicians seeking to bring better medicine and surgery to those who sought our help. While we have profited from the contributions of those in the basic sciences and in medicine and surgery, our specialty likewise has contributed its share of scientific advancements. Our responsibility lies in continuing such progress and by helping those entering the field of otolaryngology to become well-grounded and trained in the head and neck specialty. The answer to those reactionaries who would thwart every effort on our part to present otolaryngology in all of its broadened aspects should be to offer superior advantages of training and experience to all those who desire to equip themselves in the modern way.

Departments of otolaryngology should be autonomous. They should have adequate budgetary allowances for service and teaching personnel. Special services and clinics should be merely consultative without encroaching upon or depriving otolaryngological departments of material essential for adequate teaching. The department of otolaryngology, on the other hand, should show its willingness to participate in the training of residents in other divisions, especially those in which there is unavoidable overlapping spheres of interest.

This paper constitutes the third in a recent series of contributions on this subject. In the first, which had to do with "Postgraduate Training in Otolaryngology," we sought to record the plan followed by us for special practice. In the second, on "The Broadened Scope of Otolaryngology," we endeavored to show the fallacy of the general surgeon in assuming prior rights for all that he surveyed, pointing out that surgeons themselves decried the era of specialists in surgery of acute and chronic conditions of men, women and children. In this present communication, we wish to uproot the evil from the very soil which nourishes it, the medical school. We hope, thereby, to incite provocative thinking on the part of those concerned with the destiny of otolaryngology.

Only from a sincere desire to see otolaryngology survive and progress, as it rightly merits, am I presenting the problems as they exist today. It should be stressed, furthermore, that my interests are not motivated from the clinical side. On the contrary, they are actuated from the teaching side, and only as they will benefit the younger generation of otolaryngologists and make them better doctors.

1853 West Polk Street.

VENTILATION PARACENTESIS FOR THE RELIEF OF STUBBORN EUSTACHIAN TUBE BLOCKAGE.*

JOHN G. MCLAURIN, M.D.,
Dallas, Tex.

As far back as the seventeenth century, attempts have been made to restore hearing by removal of large or small portions of the membrana tympani, but it was not until the early part of the nineteenth century that Himly and Astley Cooper, working independently of each other, made artificial perforations of the eardrum and left some scientific information regarding their work. They were encouraged by the favorable results thus obtained and recommended its practice by the profession. It was only a short time before these men were convinced that the startling improvement obtained in some cases was temporary and the same degree of deafness recurred after the perforation had closed with cicatricial tissue. It was to Himly's credit that he later advised the profession to stop the destructive procedure of removing large portions of the drum, but this practice continued in Germany and France for quite a while. It seems that the poor final results were explained on partial or almost complete excisions of the drum membrane with often no regard for the ossicular chain, or on very small openings in the drum that invariably closed. Later, in the early sixties of the nineteenth century, another wave of enthusiasm developed in this regard because of improved hearing obtained in many instances following incision or medium sized perforations made in the eardrum, but it was found that the drum opening would almost invariably

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close rather promptly and the improved hearing would be lost. At that time, no efforts were made to keep the aperture in the drum membrane from closing.

Politzer recognized the importance of equalizing the difference in the air pressure between the tympanic cavity and the external atmosphere by making an opening in the eardrum. Though he did not state that there was a partial vacuum in the tympanic cavity in these cases, he did say that the opening in the drum should apply in all cases where the propagation of sound from the membrane to the stapes is interfered with. I quote Politzer as follows: "The pathological changes which indicate an opening in the membranes are: *1.* abnormal thickening and extensive, firm calcification of the membrane; *2.* ankylosis of the malleus and incus owing to immediate or ligamentous union with the tympanic walls; *3.* firm, irremovable strictures and adhesions of the Eustachian tube (Cooper); *4.* intense and troublesome subjective noises, if they are due to stricture of the tube and cannot be alleviated by bougieing." It should be noted here that the third indication was that of firm, irremovable strictures and adhesions of the Eustachian tube and the fourth indication enumerated was intense and troublesome noises due to stricture of the tube that could be alleviated by bougieing. Though he gives these as definite indications for paracentesis, he does not explain the mechanism by which the patency of the Eustachian tube occurs. He goes on to explain that by making the artificial opening in the drum, the sound waves can directly reach the footplate of the stapes and thus be communicated to the labyrinth without the aid of the drum, malleus and incus. He states that the operation can be successful only when the footplate of the stapes is movable, when the membrane over the round window is not thickened or calcified and when there is no trouble in the labyrinth. He further advises various functional tests to determine activity of the auditory nerve and states that where sound perception through the cranial bones is absent or diminished, only slight improvement can be expected from an artificial opening in the drum. Politzer made these small openings in the drum with a curved,

pointed Galvano-cautery tip and found that the improvement in hearing was retained just so long as the drum perforation remained open. Various attempts were made to keep the opening from closing, such as the inserting of catgut strings, small fish bone plugs, lead wires, silver cannulas, small hard rubber pegs and small gold tubes, but all these proved unsuccessful, because they were expelled with or without a suppurative process, and the opening invariably closed.[1]

I have gone into the history of creating openings in the drum to improve hearing and relieve noises in the ear because I feel that it is correct and proper to give full credit to those men who did some work in this respect. Though I do agree there was merit in some of the work that these men did, I am now rather convinced that the real explanation of why they obtained some good results in some cases and why they did not obtain some permanent relief in other cases was not properly explained. Unless the cause of the deafness, tinnitus and sometimes nausea associated with vertigo are fairly well understood in these cases, surely the plan of relief is likely to fail. The tinnitus is the most difficult symptom to control, though in many instances it can be modified or almost cleared to the point that the patient is quite happy about it.

At this time it is well to review just a few points in the anatomy and histology of the ear drum, the tympanic cavity and the Eustachian tube. If a full discussion of the anatomy and histology of any one of the structures was attempted, the full time for this paper could be consumed; therefore, I shall mention only those points essential to this discussion.

Regarding the eardrum, it is important to remember that it has the three embryonal layers in it: the external cuticular, which is easily separated from the middle or fibrous layer, which in turn is covered by the tightly adherent mucous membrane layer internally. It is especially important to remember that the fibrous layer is confined to the membrana tensa and is composed of an outer layer of radiating fibres and an inner layer of circular fibres. The arrangement of the radiating fibres is similar to that of the spokes and hub of a wheel, the

fibres being the spokes and the lower half of the malleus and umbo being the hub. This means that at the hub the fibres come closely together, creating thickness, whereas near the rim or annulus they are widely separated. The circular fibres are arranged in concentric circles around the umbo and are relatively sparse near the center of the membrane. They are much more numerous in the periphery of the drum.[2]

In the tympanic cavity, a few points are worthy of special mention as regards the subject under discussion. The ossicular chain has the only system of movable joints in the body, the movements of which are not under the control of voluntary muscles. Of all the movements in this chain, the most important one is that which occurs at the footplate of the stapes. Unless nerve deafness exists, there is likely to be fairly good hearing as long as the stapedial footplate can move normally at the oval window. The face and edges of the footplate, as well as the edges of the oval window, are covered with a very thin layer of cartilage. The footplate is held in articulation with the oval window by the annular ligament which consists of elastic and connective tissue fibres that extend in a radiating direction, converging at the edges of the footplate. These fibres are much longer at the anterior part of the stapes, which means that the annular ligament is much longer in front than behind. This makes the movement of the stapes against the fenestra ovalis more or less like that of a hinge that opens in front.

I wish to quote from Andrew Eggston and Dorothy Wolff as follows: "The drum membrane is said to be 20 times the diameter of the oval window, but the energy transmitted to it is absorbed by the ossicular chain so that the amount received is probably only 10 times that impinging on the drum membrane."[4]

The tensor tympani muscle arising from the great wing of the sphenoid, the cartilaginous portion of the Eustachian tube and the osseous portion of the canal in which it is contained, inserts into the manubrium of the malleus at its base. It is

supplied by a branch of the mandibular nerve through the otic ganglion. The sole purpose of this muscle is to pull the tympanic membrane medially and thus increase its tension.

The stapedius muscle arises from a hollowed out cavity in the interior of the pyramidal eminence and its tendon is inserted into the posterior surface of the neck of the stapes. It is supplied by the facial nerve and has the function of pulling the head of the stapes backward, which causes the base of the bone to rotate on a vertical axis drawn through its own center. The back of the stapedial footplate is pressed inward toward the vestibule, while the front of the footplate is withdrawn from it. By this action, the tension of the fluid in the internal ear is probably increased.[1,2,3]

Most of the tympanic cavity is lined with simple nonciliated cuboidal epithelium. As this membrane extends back through the aditus into the mastoid antrum, the cells become a simple squamous type. In the hypotympanum and near the tympanic end of the Eustachian tube, the epithelium may be ciliated and according to Politzer, whose findings were confirmed by Manasse, there are varying amounts of glandular elements in the anterior part of the tympanum around the tubal opening. There is no basement membrane but there is a subepithelial stroma. The membrane is thin but it is thick enough to transport the small blood vessels, nerves and lymph channels.[1,4]

Stimuli from various causes may create considerable edema and even the appearance of goblet cells. In fact, metaplasia may be evident in instances of certain types of chronic irritation such as infection.[1,4]

In the adult, the Eustachian tube is shaped like a trumpet at each end and is about 36 mm. in length. If the tube is healthy, the outer orifice is constantly open, but the pharyngeal orifice opens for a few seconds about once each minute. The inner orifice is about 7 mm. in its long diameter when closed and assumes the shape of an isosceles triangle, 6 mm. in height and width when open. The isthmus at the juncture of the osseous and membranocartilaginous portions of the tube is about 12 mm. inward from the tympanic orifice and it

has a calibre of about 4 mm. in height and 2mm. in width. At the isthmus, the inner surface membrane is normally rather rough. It is well to emphasize the fact that in the adult, the Eustachian tube runs upward and outward at an angle of 30 to 45 degrees off the horizontal. There is a tendency to overlook this fact so that the tip of the cannula is turned more to a horizontal position, thereby making it appear that the tube is blocked. The tube has rugae running longitudinally throughout the inner surface of its membranocartilaginous portion so that when the tube is open the rugae smooth out, but they do lie in longitudinal folds when the tube is closed. The tensor veil palatini, innervated by the Vth nerve, is probably the only functional muscle of the tube and it acts to open the tube during the swallowing, yawning and sneezing reflexes. The mucous membrane of the Eustachian tube is ciliated cylindrical epithelium which is much thicker and more loosely attached in the inner two-thirds of the tube. The ciliated cells are interspersed with goblet cells. The submucosa is abundantly supplied with lymph channels. A mixed type of gland (both serous and mucus) is found rather abundantly in the submucosa of the inner third of the tube. An organized type of lymph node, known as Gerlach's tubal tonsil, is described as appearing in the Eustachian tube, but according to Wolff it appeared in only one out of 47 tubes sectioned and then in a child who had an otitis media. In the presence of infection, organized patches of lymph cells are frequently seen.[2,4-7]

In January, 1925, I first did a paracentesis on an eardrum in order to relieve a very stubbornly blocked Eustachian tube. I have since used the term "ventilation paracentesis" to describe the procedure. Prior to 1925, I had never done a paracentesis for the distinct purpose of creating patency in stubbornly blocked Eustachian tubes. It was with trepidation that I did the first paracentesis for this reason alone, because I had always been taught in my otological training that the eardrum was hallowed ground and that one was not justified in opening the drum unless the drum itself indicated disease in the middle ear. My boldness in doing this first ventilation

paracentensis was based on the fact that I had observed that it was rare to find a Eustachian tube blockage when there was a perforated eardrum, regardless of what had produced the perforation. I had further observed that the only instances of the tube being blocked while the drum was open were under one of the following conditions: namely, *1.* a tumor in the pharynx, whether benign or malignant, that obstructed the Eustachian tube; *2.* where a very firmly formed stricture had developed in the tube, usually at the isthmus, probably resulting from a rather violent infection that had ascended the Eustachian tube from the pharynx; and *3.* where there had been an adhesive type of middle ear infection that had created adhesions of the eardrum to the inner wall of the tympanum in such a way that the tympanic orifice of the tube did not open into that part of the middle ear chamber that was ventilated by the opening in the drum.

Since January, 1925, I have used ventilation paracentesis on approximately 92 cases. I have been agreeably surprised in about nine out of 10 instances to find that as soon as air entered the middle ear through the drum incision, the Eustachian tube inflated well with very moderate air pressure. The exceptions to this have been mentioned previously. As a matter of fact, in many instances where repeated bougieing has indicated a very tight resistant stricture, the tube has frequently inflated well as soon as the drum was incised. It continued to inflate at subsequent treatments so long as the drum opening existed. I have encountered instances in which I could pass a sound by what seemed to be a stricture and no air would enter the middle ear on efforts of inflation, and yet the inflation seemed quite normal as soon as the drum was incised. Passing a sound may indicate that more than one stricture has been successfully dilated, but one or more of the strictures will tighten down within a minute or so after the sound has been withdrawn. The tube may inflate well or poorly with a high squeak, only to close again in from a few seconds to two or three minutes.

It has been my practice to dilate these tightly strictured tubes or those tubes that are generally tight throughout most

of their length at intervals of five to seven days for six to 12 times before resorting to ventilation paracentesis. Other measures, both local and general, were also taken to maintain patency of the tube. This has been my practice because I thought it was the conservative attitude that one should take, but after reviewing some cases I have concluded that much time would have been saved for the patient if the drum had been incised earlier; however, time had not been squandered entirely because during that period when bougies were passed and the tube inflated at intervals with varying degrees of success, efforts were being made to clear up any pathology in the nose, sinuses, pharynx and throat. In the past few years, radium therapy has been used where there seemed to be some hypertrophied lymphoid tissue in the pharyngeal orifice of the tube; furthermore, luetic infections had to be handled in some cases and there was always that possibility of neoplasm that one could not afford to overlook.[7]

A large number of these were hypothyroid cases and, therefore, had to receive thyroid therapy, which seemed to improve the chances for developing a patency of the tubes. General metabolic disturbances received proper therapy. Allergy was present in a large percentage of cases, so the usual measures to control it were adopted. This has been more readily accomplished since the development of antihistaminic agents. Prior to the advent of antibiotics, I occasionally followed an inflation with the passage of a wire Eustachian applicator of 1 to 2 per cent silver nitrate, hoping thereby to promote a gradual thinning out of the tubal mucosa. Now I use weak sodium sulfathiazole or penicillin solution in these tubes with probably a greater degree of success in promoting a healthy state of the tubal mucosa.

Deformed nasal septa, causing faulty air currents, compensatory hypertrophy of the turbinates and poor ventilation and drainage of the sinuses, can surely cause trouble in the Eustachian tubes in many cases; therefore, these deformities should be corrected by surgery. Any of these measures may prove most essential in establishing a permanent patency in the tubes and must be carried out either before or after a venti-

lation paracentesis is done; my experience has been that in some cases all of the measures have failed to produce a patency of the tube; therefore, it became necessary to incise the drum. For this reason, I have done ventilation paracentesis on approximately 92 cases.

In a few of these cases only one incision was necessary, but in most cases three to six incisions were necessary, despite the fact that every effort had been made to keep the incision from closing by spreading the edges apart with a No. 1 Bowman sound every two or three days. In two cases, it has been necessary to make as many as eight incisions before the tube stayed open after the drum incision closed. At this time I have only one drum that is still open and that one is in a young lady who had her drum opened by incision eight times. Finally, a few months ago I incised the drum and then punched out along the line of incision. This punched out opening is now about one-fifth its original size and will undoubtedly close. I have never seen one of these openings fail to close. As a matter of fact, I feel very certain that the drum should be permitted to close permanently when the thickening in the membrane and other soft structures of the tube has thinned out to the point that the tube remains patent after the drum opening closes. In this regard, I do not agree with Politzer, who tried so many measures to keep the drum open and finally felt that he had failed in his efforts in such cases because he could not establish a permanent opening in the drum. It is probable that Politzer was giving much more thought to the establishment of vibrations of the stapedial footplate by sound waves that came directly through the drum opening and was giving little thought to developing permanent patency of the tubes.

It is true that in such cases where the tube has been closed the hearing is almost invariably improved by making a fairly large opening in the drum. As a matter of fact, my patients have frequently requested me to keep the drum open for them because their hearing was better, vertigo nearly always relieved and tinnitus either gone completely or definitely decreased. They learn from experience that when the drum

closes before the tube has recovered to the extent that it will stay open their previous symptoms are likely to recur. The drum, however, should be permitted to close after the tube has become healthy enough to stay open; otherwise if an acute cold supervenes there is considerable danger of infected material being blown from the pharynx out the tube, causing an acute otitis media. I have seen this happen but have also noted that such an otitis media always clears promptly because of perfect drainage through the drum opening and a patent tube. When the tube remains open after the drum closes, the patient is likely to complain of some loss of hearing and increased tinnitus at the time of drum closure, but hearing by air conduction will gradually improve and the tinnitus will probably become less noticeable.

Prior to the opening of the drum, the patients on whom I did ventilation paracentesis complained principally of the following symptoms: *1.* a loss of hearing in varying degrees; *2.* autophony; *3.* tinnitus; *4.* and in many instances vertigo, occasionally associated with nausea and vomiting when the vertigo is most marked. The vertigo was relieved almost at once by ventilation paracentesis. The hearing was improved in nearly every instance and the tinnitus either disappeared or was reduced to a point of tolerance. I must admit, however, that the tinnitus is the most persistent of the symptoms mentioned, but that can probably be explained by the fact that tinnitus can be due to so many various causes. My idea of what existed prior to paracentesis was a condition that was secondary to a primary blocking that had taken place in the Eustachian tube, probably the result of some acute infection or a part of the picture of catarrhal otitis media. Of course, catarrhal otitis media can cover various types of trouble that occur in the middle ear and Eustachian tube. When the tube became blocked and did not open after the infection subsided, then a partial vacuum developed in the middle ear, extending through the aditus to the mastoid antrum and to some extent involving all of the mastoid cells. As a result of this partial negative pressure, an edema was probably produced in the middle ear that extended to the mastoid cells. The edema

itself was capable of interfering with free movement of the ossicular chain and especially with the movement of the footplate of the stapes at the oval window. The vacuum in turn produced a definite tug on the membrane of the Eustachian tube at the point external to the constricted part, thereby intensifying the tightness of the tube. Unless this vacuum could be broken by air getting into the middle ear, a vicious cycle would be established. In other words, the blocked Eustachian tube created a vacuum which increased the tightness of the tube.

As mentioned before, I have in a few instances heard a short, high-pitched whistle at the time of incision. As a rule, however, this did not occur because the difference in the air pressure on two sides of the drum was evidently more or less equalized by an effort on the part of nature to prevent a high degree of vacuum by developing enough edema in the middle ear to offset it. It was perfectly logical to assume that there had also been enough edema around the footplate of the stapes and oval window to prevent the free movement of the footplate and there was probably enough edema to prevent the normal movements in the other joints of the ossicular chain; furthermore, there was surely an impairment of a prompt response on the part of the drum to sound waves striking its outer surface because of the difference in air pressure on the two sides of the drum. Neither could the drum move as freely inward as it should because there was a fixed air pressure in the middle ear due to blocking of the tube.

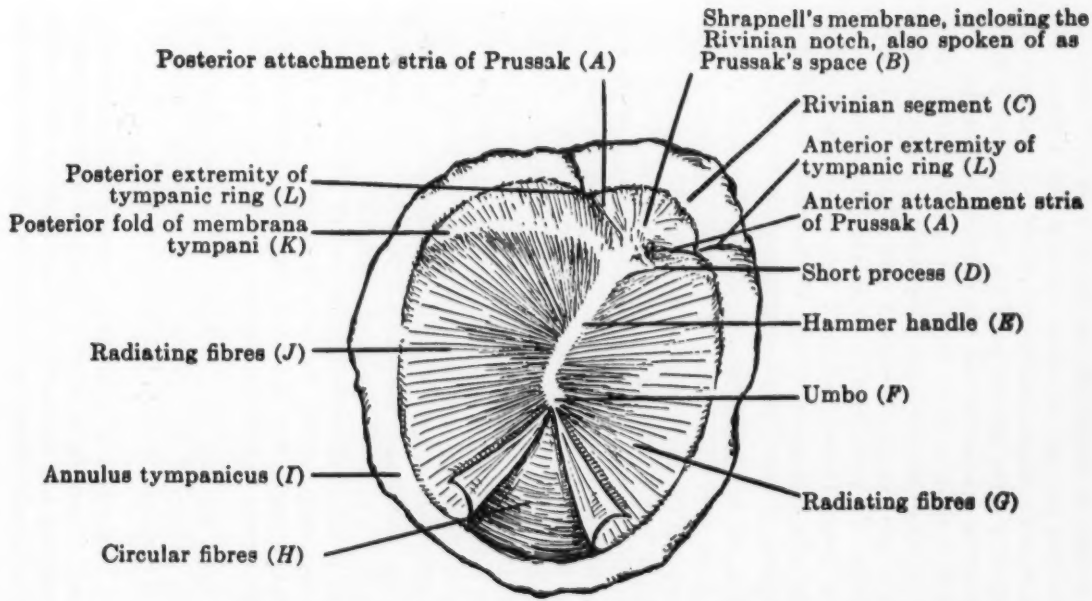
I did not do this ventilation paracentesis on any patients to relieve any special type of middle ear infection. As a matter of fact, the fire of any previous infection was probably out in nearly every case where the procedure was adopted. I was certainly not seeing the type of case that Dr. Watt Eagle so excellently described in his paper entitled, "Secretory Otitis Media" and reported in the March, 1946, *Annals of Otology, Rhinology and Laryngology*. The reason I state that these were not the cases on which I was doing this paracentesis is that there was no fluid level with or without bubbles in the

fluid, and that in practically no instance have I found an escape of fluid through the drum opening that I made. The condition that Dr. Eagle describes was one that was probably the result of a virus disease with the formation of a thick, viscid fluid that frequently had to be removed by suction. He reports 172 such cases and I have seen a few of these cases, but have felt justified in the past few years in giving adequate drainage by paracentesis because a fluid did exist in the tympanic cavity. I have also used some suction through a low horizontal drum incision which I believe creates a better chance for the continuous escape of the viscid fluid that is rather typical of this type of secretory otitis media.[8]

Dr. James D. McCall, of Mineral Wells, Tex., read a paper on Dec. 3, 1948, at the meeting of the Texas Society of Ophthalmology and Otolaryngology at Fort Worth, Tex. The title of his paper was "Secretory Otitis Media," but in conversation with him, he tells me that he intends to change the title to "Allergic Transudatory Otitis Media." He states that there are three stages of the disease, namely: *1.* stage of tight tubal blockage with a retracted eardrum, indicating vacuum in the middle ear; *2.* stage of transudation of fluid in the tympanic space with no elements of inflammation in the fluid; *3.* adhesive stage, due to slow absorption of fluid, leaving fibrin behind that causes crippling of hearing due to adhesions in the middle ear. He makes a plea for early paracentesis in order to prevent the adhesive stage, and further states that there is little reason to fear secondary infection. Since he feels reasonably certain that allergy is the etiologic factor, he attempts in every way to control the allergy and uses antihistaminic agents as valuable therapy.[9]

Here again we find how valuable paracentesis can be in promoting patency of the tube and also in creating ventilation as well as drainage through the drum incision.

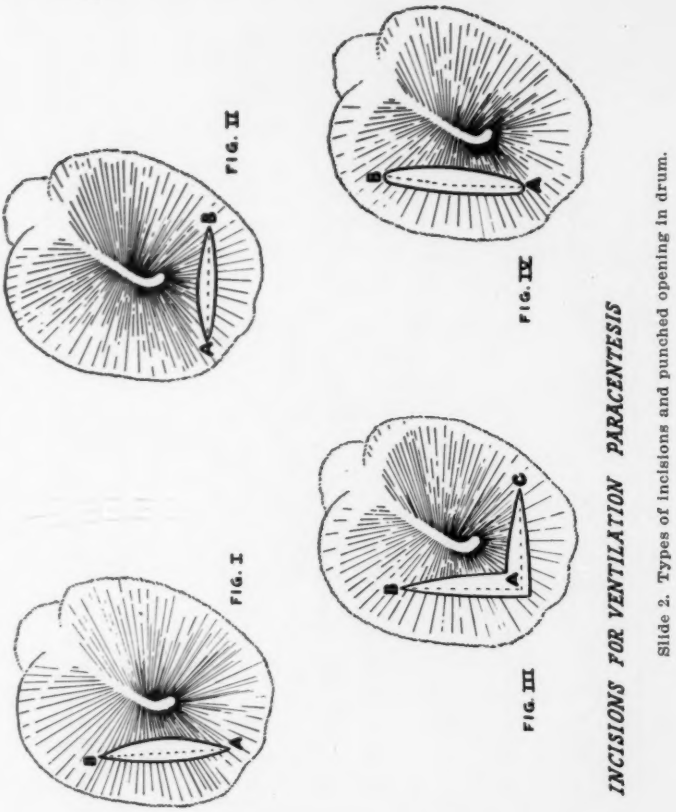
Slide 1. This is a diagrammatic picture of the eardrum (Kerrison). Attention is called especially to the arrangement of the radiating and circular fibres that constitute the middle layer. The circular fibres are much more numerous toward


Shrapnell's membrane, inclosing the Rivinian notch, also spoken of as Prussak's space (B)
Posterior attachment stria of Prussak (A)
Rivinian segment (C)
Anterior extremity of tympanic ring (L)
Posterior extremity of tympanic ring (L)
Anterior attachment stria of Prussak (A)
Posterior fold of membrana tympani (K)
Short process (D)
Hammer handle (E)
Radiating fibres (J)
Umbo (F)
Annulus tympanicus (I)
Radiating fibres (G)
Circular fibres (H)

Diagrammatic picture of the membrana tympani and its attachments.

Slide 1. Diagrammatic picture of the eardrum (Kerrison) showing the arrangement of the circular and radiating fibres.

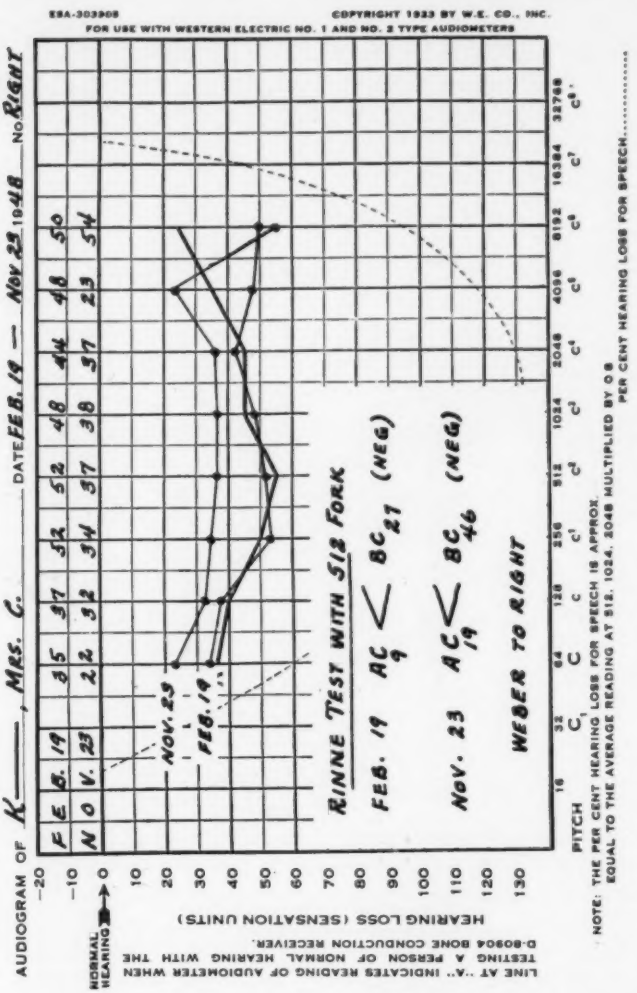
the annulus than in the region of the umbo; whereas the radiating fibres that are external to the circular fibres are much closer together near the umbo than at the annulus. These points should be remembered because they have an influence on the shape of the opening created by incision of the drum.



Slide 2. Types of incisions and punched opening in drum.

Slide 2. This shows the types of incisions and punched opening in drum. Fig. I shows circumlinear incision (A to

B) in lower posterior quadrant with more gapping toward the umbo due to pull of radiating fibres. Dotted line is where incision was made. Fig II shows straight incision (A to B)


AUDIOGRAM OF K——, MRS. C. DATE FEB. 19 — NOV 23 1948 No. RIGHT
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WEBER TO RIGHT
HEARING LOSS (SENSATION UNITS)
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NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX. EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-80904 BONE CONDUCTION RECEIVER.
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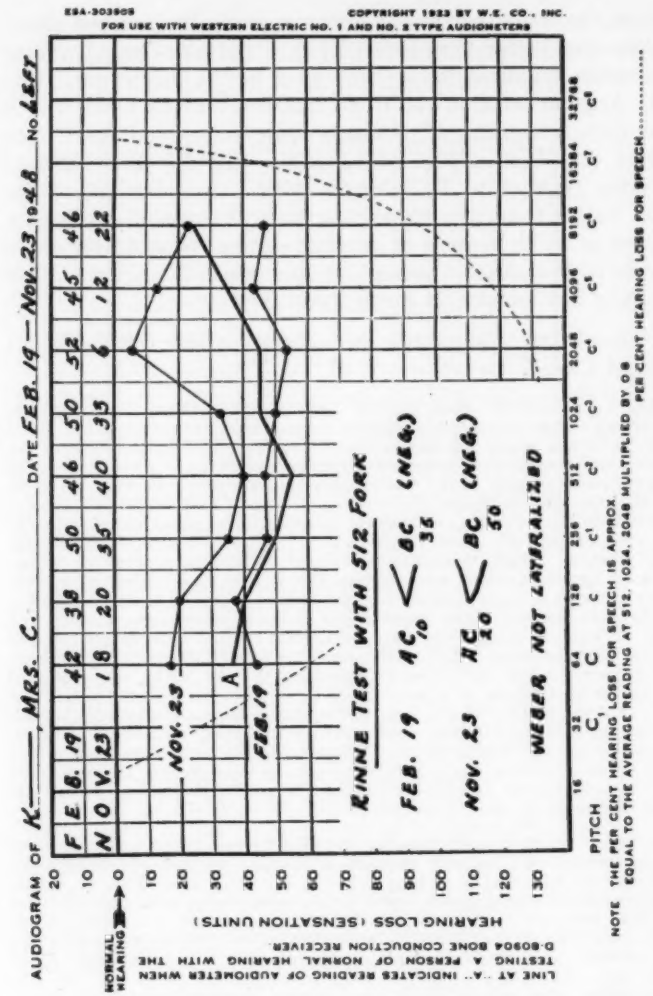
Slide 3. Audiograms of right ear on Case 1.

across the lower portion of drum, gapping toward the umbo. Stays open better than that of Fig. I and also has advantage of better draining off of any fluid in the midle ear. Fig. III. Angular incision (A, B, C) made by cutting from A to B and then from C to A. Spreads open widely and stays open longer than that of Fig. I or Fig. II. Fig. IV. Circumlinear incision from A to B, enlarged with punch forceps. Stays open longer than any others described. Somewhat more dangerous to make because of possible damage to ossicular chain due to poor chance of seeing how the punch is engaged. This punched out incision is rarely necessary.

Slides 3 and 4 show the audiograms on the right and left ears of Case 1.

Mrs. C. K., age 48. Seen first on Feb. 16, 1948, stating that deafness, throbbing sound and tinnitus started in both ears rather suddenly about four years ago when she had a heavy postnasal discharge following an acute cold. Stated very positively that she never had any trouble with hearing prior to that time. Much heavy mucopurulent discharge seen in middle and superior meati of each side. Stereo X-rays of sinuses showed all sinuses clear except considerable blurring throughout entire ethmoid cell area of both sides. B. M. R. was 0. Vesperal temperature normal. B. P., 110/65. Blood Wassermann normal. Moderate amount of hypertrophied lymphoid tissue seen in each Eustachian tube orifice. First cannular inflation of right Eustachian tube showed complete blockage. Sounding of tube showed tight stricture in isthmus which was dilated and then air entered middle ear with a squeak. No air entered left middle ear on first cannular inflation but sound showed tube tight throughout but apparently not strictured. Cannular inflation with sounding and occasional application of 1 per cent silver nitrate throughout both tubes done 21 times at intervals of four to five days. Proetz displacement treatments and Dowling tampons used alternately to help control ethmoiditis, which did respond nicely to this therapy. Radium applied to each orifice four times according to Crowe technique. After all this therapy, ears were apparently no better, both tubes seemingly blocked to about the same degree as on first treatment.

On May 3, right tube completely blocked. Incised drum and then tube inflated wide open without passage of sound. Patient stated hearing improved at once and throbbing sound, which was patient's own pulse, disappeared. Tinnitus much better. One week later, left drum incised and tube then inflated wide open. Patient experienced same relief as on right side, except that tinnitus was even more greatly relieved. The improvement was maintained in each ear when the drums and tubes were open. The right drum has been incised three times and the left drum twice. The patient could hear normal conversational voice at 15 feet with the right ear immediately after the third incision, but this was true of the left one after the first incision. No fluid found in the tympanic cavity after any incision. Both drums have been closed two months. Left tube is wide open and hearing in left ear is quite satisfactory, with no pulsations and very little tinnitus. The right tube is not strictured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FOR USE WITH WESTERN ELECTRIC NO. 1 AND NO. 2 TYPE AUDIOMETERS
AUDIOGRAM OF K.——, MRS. C. DATE FEB. 19 — NOV. 23 1948 No. LEFT
FEB. 19 42 38 50 46 50 52 45 46
NOV. 23 18 20 35 40 35 6 12 22
NOV. 23
FEB. 19
A
RINNE TEST WITH 512 FORK
FEB. 19 AC/10 < BC 35 (NEG.)
NOV. 23 AC/10 < BC 50 (NEG.)
WEBER NOT LATERALIZED
HEARING LOSS (SENSATION UNITS)
NORMAL HEARING
PITCH C1 C c c1 c2 c3 1024 c4 2048 c5 4096 c6 8192 16384 32768
NOTE THE PER CENT HEARING LOSS FOR SPEECH IS APPROX EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH.....
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-80904 BONE CONDUCTION RECEIVER.

Slide 4. Audiograms of left ear on Case 1.

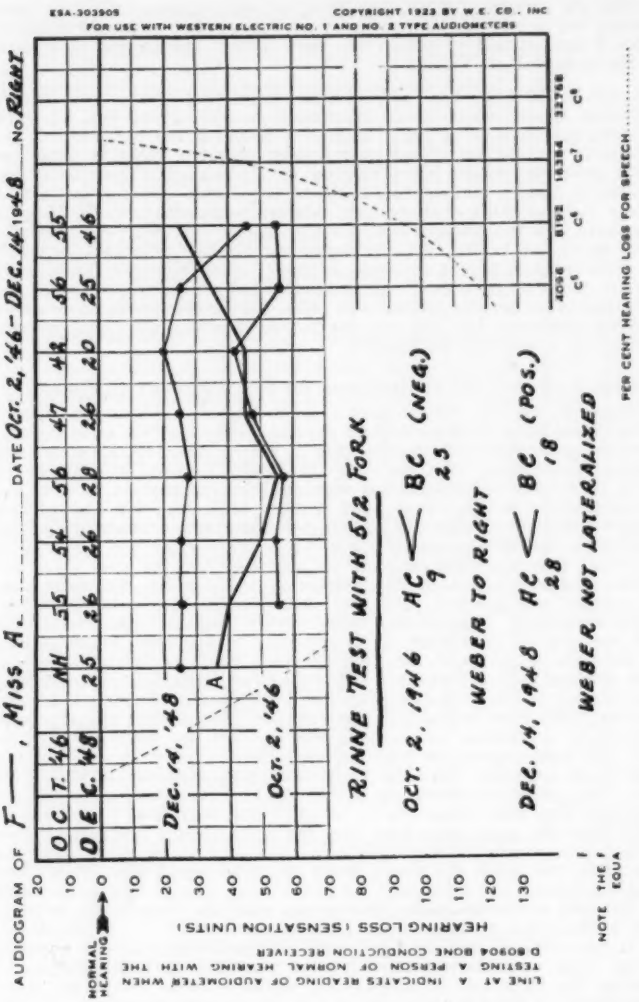
now, but is not open freely at each treatment. When it is open, patient does not complain of tinnitus and pulsations in that ear and hearing is satisfactory, but when the tube is closed these symptoms with diminished

hearing are present. I think the right ear will require ventilation paracentesis one to possibly three more times, but as long as it will inflate at times, I am hesitant to reopen the right drum. The patient is anxious for me to do so.

It will be seen on these audiographic charts that this patient showed a marked improvement in her hearing from Feb. 14 to Nov. 23, 1948, with the exception of a slight drop in hearing in the right ear in the high pitch of 8192 dv. These charts show negative Rinne in each ear, which probably means some fixation of the stapedial footplates, but because of history of deafness, audiographic curves and the findings of tightly blocked tubes with marked bilateral ethmoiditis, it is doubtful that there is a true otosclerosis. I really believe that the patient is mistaken about not having had any deafness until four years ago and that she probably does have a moderate degree of otosclerosis, but I'm equally positive that the air conduction deafness did start about four years ago when the tubes became blocked. In other words, this really is probably a mixed deafness, but the air conduction deafness has been greatly relieved by ventilation paracentesis.

Slide 5 shows the audiograms on the right ear of Case 2.

Miss A. F., age 30. Patient seen first on July 25, 1945, with complaint that she had been dizzy for several days at a time for four months. Had also been gradually losing her hearing in the right ear for several years. Examination showed that she had chronically diseased faucial tonsils and a very badly deformed nasal septum. She was advised to have her tonsils removed, which was done in October, 1945. She was also advised to have a submucous resection to help her in clearing a bilateral residual ethmoiditis, but this operation has never been done. At her first visit it was found that her right eardrum was retracted and the tube would not inflate until a stricture in the midportion was dilated. The left drum was normal and the left tube was slightly sticky but dilated readily. Proetz treatments were started twice weekly and the right Eustachian tube was treated each time. A bougie was passed once weekly across the stricture in the right tube, but the tube would invariably be closed when inflated with a cannula a few days later. Inflations of right tube were attempted about 30 times without any apparent benefit. I am not showing her earlier audiograms but only the one made on the day prior to the first ventilation paracentesis and the last one made on Dec. 14, 1948. No improvement in hearing was obtained prior to opening the right drum, at which time the Eustachian tube promptly inflated wide open. The patient immediately stated that her hearing was markedly improved. She even called me by phone a few days later to tell me of things that she could then hear that she hadn't heard previously. This marked improvement of hearing continued so long as her drum and tube were open, but when the drum closed the tube would also block. The drum was incised five times, and the tube stayed open so long as air could get into the tympanic space through the incision. Finally, in October, 1946, a circumlinear incision was made in the lower posterior quadrant, but it was widened and extended downward and forward with a punch forcep. This was followed after four or five days by a disturbance of taste on the right side of tongue that lasted to some extent for about three weeks. I did not think that I had cut the chordae tympani nerve and felt reasonably sure that there must have been some postoperative edema around the nerve. The hearing has been constantly satisfactory to the patient except on two occasions when she had an acute cold, at which time some mucoid discharge came through the drum opening. This


ESA-303905
COPYRIGHT 1923 BY W.E. CO., INC
FOR USE WITH WESTERN ELECTRIC NO. 1 AND NO. 2 TYPE AUDIOMETERS
AUDIOGRAM OF F——, MISS A. DATE Oct. 2, '46 - DEC. 14, 1948 No. RIGHT
O C T. '46 NH 35 35 54 56 47 42 56 55
O E C. '48 25 26 26 28 26 20 25 46
DEC. 14, '48
OCT. 2, '46
A
RINNE TEST WITH 512 FORK
OCT. 2, 1946 HC < BC (NEG.) 9 23
WEBER TO RIGHT
DEC. 14, 1948 HC < BC (POS.) 28 18
WEBER NOT LATERALIZED
HEARING LOSS (SENSATION UNITS)
NORMAL HEARING
LINE AT A INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D 6904 BONE CONDUCTION RECEIVER
NOTE THE F EQUA
PER CENT HEARING LOSS FOR SPEECH
4096 8192 16384 32768
C5 C6 C7 C8

Slide 5. Audiograms of right ear on Case 2.

has cleared promptly and the ear is perfectly dry now. The drum opening is now just about 2 mm. in diameter and I'm sure it will be closed when I see this patient again. I want to repeat that I've never seen one

of these openings refuse to close. This young lady had a negative Rinne in the right ear when she was first treated, but it is now positive. There is a greater loss in the upper tones but this has also shown some improvement, which makes one doubt that a real nerve deafness exists. She does have some lymphoid tissue hypertrophy in the right Eustachian orifice but she has never agreed to have radium therapy. These audiograms show a marked improvement in hearing in the right ear from Oct. 2, 1946, to Dec. 14, 1948, during which time the Eustachian tube has been kept open by ventilation paracentesis. It should also be noted that the Rinne test which was negative originally is now positive, a change which was hardly to be expected.

CONCLUSIONS.

1. Ventilation paracentesis has proved to be most valuable in relieving stubbornly blocked Eustachian tubes that did not respond satisfactorily to efforts of dilatation, inflation and other local measures, as well as to therapy to improve the general health of approximately 92 patients.

2. The procedure is a safe one and the drum will invariably close with no apparent damage to it. The drum should finally be permitted to remain closed when the tube regains a healthy state.

3. As a rule, there will be an improvement in air conduction hearing, relief of autophony, control of vertigo if of a type that is associated with tubal blockage, and relief or some improvement of a co-existing tinnitus.

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SUBCUTANEOUS RUPTURE OF TRACHEA FROM LARYNX BY EXTERNAL TRAUMA; WITH STENOSIS AND RECOVERY.*

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On Jan. 8, 1947, I was called to see a boy of 15 who was having difficulty in breathing. About 30 minutes before, while riding a motor scooter out of an unlighted parking lot, he had run into a chain stretched across the entrance. The chain had caught him across the neck and thrown him off the scooter. He could breathe fairly well while sitting with his chin held well up. He had coughed up a little blood, could talk only in a whisper, and there was very sharp pain on swallowing.

CASE REPORT.

Examination showed no laceration of the skin; swelling over the larynx was moderate, and there was no crepitus. Extreme tenderness prevented careful palpation. The larynx was easily inspected with a mirror, and there was no movement of the cords on breathing or phonation. The cords were open at about 15 degrees, and a little fresh blood was seen streaked over the left cord. A diagnosis of probable dislocation of the laryngeal cartilages was made, and the patient was admitted to the Huntington Memorial Hospital.

A little oxygen was given at intervals, and he got through the night very well. At seven o'clock the next morning he was no worse, but still there was no motion of the vocal cords. At noon, 15 hours after the accident, breathing was worse and tracheotomy was decided upon.

As usual, a bronchoscope (7 mm.) was passed to insure a good airway during the procedure. A little below the cords, the scope entered an area filled with blood clot and the lumen of the trachea was found with dif-

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†From the Department of Otolaryngology, School of Medicine, University of Southern California, Service of Dr. J. Mackenzie Brown.

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ficulty. The scope was passed down to the bifurcation and a few blood clots were sucked out. After injection of 1 per cent novocain, incision was made, and the trachea was found to have been torn completely away from the larynx with a separation of an inch or more. The tear was transverse and occurred just below the cricoid cartilage. The tracheotomy tube was placed as low as possible. In order to keep the edges in good position and to prevent stenosis, a section of rubber tubing was left inside the trachea. The trachea was sutured back to the larynx with three strands of No. 1 chromic catgut. The intratracheal tubing was a section of rubber urethral catheter, the largest size that could be inserted without pressure. In order to hold it in place, a suture of chromic gut was passed through the tube and the torn edge of the trachea.

Intranasal feeding was done for a few days and then patient swallowed food without much difficulty. In spite of penicillin there was some bronchitis. Dr. Jesberg and Dr. Alden Miller were consulted, and it was decided to take out the intralaryngeal tube in three weeks. This was done by passing a laryngoscope and grasping the upper edge of the tubing. At first the breathing space was good, but in two weeks stenosis had occurred to the point of almost complete closure. It was decided to keep the strictured area dilated with rubber sections passed up through the tracheotomy wound following technique developed by Dr. Jesburg.[1] He was turned over to Dr. Alden Miller, who has done a great deal of this work with Dr. Jesberg.

It was impossible to dilate the stricture sufficiently with retrograde bougies and rubber tubing sections, so tracheostomy and removal of the scar tissue was done on April 8, 1947. The scar was narrow and dense and located just below the cricoid cartilage. After excision of the scar a rubber tubing, size 34 French, was inserted and anchored to the tracheotomy tube. The tubes were changed every two or three weeks and finally left out six months after the injury. Three weeks later he developed a case of bulbar poliomyelitis that was almost fatal. He recovered, however, with no residual paralysis. On Nov. 10, 1947, the tracheotomy tube was removed and later the wound was closed.

There has been no return of motion of the vocal cords. The voice is a rough whisper. The cords are fixed with arytenoids about 4 mm. apart, and there is adequate airway.

COMMENT.

The tendency for injuries of the larynx and trachea to stenose is well known. The same tendency is present in complete lacerations of the ear canal and of the nose. These injuries must be kept open with some form of dilating material. Rubber tubing is rather irritating and cannot be left in place much longer than two weeks. Acrylic molds made of dental plastic require time and a special laboratory for their construction. If a similar case were encountered, I would try to obtain a piece of plastic tubing of the proper size and leave it in place for six months. It has occurred to me that the

intratracheal tubing, of plastic material such as the anesthetists use, would be an ideal material and would be on hand in most hospitals in different sizes. This could be anchored to a tiny ring soldered to the back of the tracheotomy tube as described by Jesberg. It would then be unnecessary to leave the wound open as widely as is advised by Erich in using his special acrylic mold of dental compound.

Several unusual features were present in the above case. In spite of the complete rupture of the trachea, there developed no subcutaneous emphysema. The fact that there has been no return of motion of the vocal cords indicates injury to the recurrent laryngeal nerves. It is possible that nerves were torn away from the larynx by the wide separation of the torn parts. In spite of the extensive damage, there was not enough bleeding to cause much coughing or choking. The extent of the damage was not suspected until the incision for tracheotomy was done.

There have been only a few reports of rupture of the trachea or bronchi without laceration of the skin. In none of the cases was an actual complete rupture seen and verified, but it is probable that it did occur in some of the cases reported.

Holinger[2] read a paper at least year's meeting of the American Laryngological, Rhinological and Otological Society, Inc., in which he described three cases with sustained rupture of one of the main bronchi due to external chest trauma, two of which cases were children five and six years of age. In all of them complete stenosis developed. In two of his cases removal of the completely atelactatic lung was done. It was not possible to dilate the strictures. He mentioned that R. A. Daniel had in press a report on successful experimental repairs of ruptured bronchi with glass, metal and plastic material.

Foster[3] reports a case that sustained a rupture of the trachea just below the cricoid from a glancing blow over the chest. He rapidly developed massive emphysema from his

forehead to his knees. He was suffocating when an emergency tracheotomy was done. He recovered, but developed stenosis just below the cricoid.

Cummings[4] reported a case of rupture of the trachea caused by the patient being thrown forward against the back of the front seat of an automobile. This case developed emphysema from the lower face to the midchest, but did not have a tracheotomy done until the next day. Stenosis developed just below the cricoid.

Erich[5] has described the method he has developed at the Mayo Clinic for the treatment of tracheal or laryngeal stenosis. After excision of the scar by open operation, the raw area is skin-grafted and a rubber sponge left in the trachea for 10 days. A mold is then made of dental plastic material and left in place for six months. This method was described again at the last College of Surgeons' meeting in Los Angeles by Erich.

SUMMARY.

A case of rupture of the trachea with wide separation of the trachea from the larynx is reported. The literature for the past 10 years is summarized.

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SCLEROMA OF THE LARYNX, TRACHEA AND BRONCHI.*†

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Scleroma is a chronic infectious granulomatous disease of the respiratory tract. The first reports of this disease described lesions in the nose, and thus the term rhinoscleroma was given to it. In these early papers the process was always considered to be primary in the nose. The first cases were reported by von Hebra in 1870, and in 1882 von Frisch discovered and described a Gram-negative bacillus occurring in the nasal secretions and involved tissues of patients with this disease. This organism, Klebsiella rhinoscleromatis, is still listed as the bacillus of Frisch and is considered by most students of this disease as its cause. It was soon established that the diease can extend or can probably primarily involve any part of the respiratory tract. In 1932, the International Congress of Otology, Rhinology and Laryngology at Madrid, Spain, officially adopted the term scleroma.[10] There now have been many cases reported and many excellent descriptions of the disease as it affects the nose but few describing constant or typical laryngeal involvement and very few describing the lesions produced by scleroma in the bronchi. For this reason three recent cases from the Los Angeles County General Hospital are being reported as they illustrate common findings in

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the larynx, trachea and bronchi, and because all three of these cases were treated with streptomycin with interesting results.

INCIDENCE.

It was first thought that the disease existed only in southern Europe, but it is now known that while not common it may be found anywhere and in probably any nationality. It is endemic in the Balkan states and thousands of cases have been reported from that area. Laryngeal scleroma was first described by Gerhardt in 1876. Watkins,[11] in 1921, reported the first case of scleroma in this country in a native American and described it as being primarily of the larynx and trachea. The first case recognized in California was reported by Alderson[1] in 1914.

The disease occurs almost equally in both sexes and at almost any age, but with the greatest incidence between the fifteenth and thirty-fifth year. Poor hygiene seems to be a factor as by far the greatest number of patients seem to have a background of uncleanliness or poor sanitation.

PATHOLOGY.

Grossly the lesions are usually described as being of an indurated, infiltrative nature, causing granulomatous submucosal thickening and stenosis of air passages. Szmurlo[3,10] classifies the lesions into a discrete nodular type and a diffuse infiltrative type and describes three stages in their development:

1. First, a diffuse stage with early infiltration of the submucos and atrophic changes in the mucosa. In this stage there is secretion of foul smelling discharge and much crust formation. It is felt that this early stage of scleroma is many times confused with and misdiagnosed as atrophic rhinitis with ozena. Dr. Wexler, of our ear, nose and throat department, re-examined 27 patients who had during the one year, 1947, a clinical diagnosis of atrophic rhinitis and revealed positive biopsies and cultures for scleroma in seven of these patients.

2. The second is a circumscribed stage in which there is first a discrete small nodular infiltration emerging from the surface and in which there may be only one nodule present. Soon a large number of nodules coalesce into large granular, firm masses which are so hard that they give the feeling of cartilage. This more diffuse granulomatous process may present large granulomatous masses which may be seen either *a.* extending widely throughout the submucosal area, or *b.* thinning and elevating the mucosa so that there is marked encroachment upon the air passages. Usually the mucosa is intact and rarely is there ulceration unless there has been trauma to the lesion.

3. The third stage is a stenotic, fibrotic stage in which connective tissue infiltration replaced most of the submucosal diseased area and a concentric stenosis is usually present. Here, too, the mucosa is usually intact and smooth, although many times injected and indurated.

Putschowsky[3] would further divide the above second stage into two parts: An early soft stage of indefinite granulation tissue, and later cartilage-hard phase when foam cells and hyaline bodies are present.

Microscopically, a characteristic picture is described by all writers. Overall, the picture is that of a granuloma. There is papillary hyperplasia and hypertrophy of the surface epithelium. Beneath the epithelium the lamina propria is trabeculated and intensely infiltrated with many plasma cells and the large foam or Mikulicz cells. These Mikulicz cells, supposedly characteristic of scleroma, have centrally placed nuclei around which the cytoplasm is divided into large, empty compartments giving the cells their "foamy" or "lacy" appearance. Within these large vacuoles are found the bacilli of Frisch, the invasion by which causes the vacuolation. There is usually present another characteristic cell, the so-called Russell bodies, which are plasma cells with an excentrically placed nucleus and a cytoplasm which stains intensely with eosin. This typical histological picture of scleroma is best found during the second or "hard" infiltrative stage. In

the early or atrophic stage, the Mikulicz cells and Russell bodies may not have appeared, while in the third stage there is an increase of fibrous connective tissue and a diminution in the number of specific cells and bacilli.

BACTERIOLOGY.

Not everyone agrees that the bacillus of Frisch is the etiological agent, although it is almost always cultured in this disease. Figi and Thompson[5] and Cunning and Guerry[2] agree with some of the earlier workers that this bacillus is a secondary invader and is found in other diseases as leprosy, glanders and bubonic plague; however, Levine and Hoyt[6] are convinced from their experimental studies that the bacillus of scleroma is not found in the normal nose or throat and that it can be isolated in all cases of scleroma and has a characteristic cultural pattern. The same opinion was held by Lasagna in 1925.

SYMPTOMS AND FINDINGS.

The three case reports will serve to illustrate the symptoms and findings usually found in scleroma involving the larynx, trachea and bronchi and to introduce the subject of treatment.

Case 1: R. T., a 17-year-old Mexican female, born in southern California, first appeared at the Los Angeles County General Hospital on April 27, 1936, because of difficulty in breathing. A large granulomatous mass in the anterior commissure of the larynx was clinically diagnosed as papilloma, removed and the biopsy reported as an "ulcerated benign polyp."

In June of 1936 a total of 3,000 r of deep X-ray therapy by the Coutard method was given to the larynx because of much thickening of the anterior half of both true and false cords.

In September ,1936, a diagnosis of atrophic rhinitis and pharyngitis was made.

In January, 1941, a diagnosis of asthma was made in the out-patient clinic, and in February, 1941, the patient was hospitalized for a time with the diagnosis of bronchopneumonia.

On Sept. 21, 1942, the patient was readmitted because of increasing difficulty in breathing for the past nine years. No relief was obtainable with epinephrine. There were signs of right upper lobe bronchus obstruction and consolidation in the right upper lobe. Bronchoscopy revealed the larynx to be normal except for reddening and thickening of the true cords, but their movement was restricted so that the bronchoscope could

barely be passed. Beneath each cord was a granulomatous-like thickening and the entire tracheal lumen was narrowed so that the scope was not passed. Following a course of sulfadiazine therapy, the patient was rebronchoscoped one month later on Oct. 9, 1942, at which time there was less thickening of the mucosa of the larynx and trachea, but the right main bronchus was completely obliterated by what appeared to be a fibrotic scar with numerous small perforations suggesting a sieve. This obstructing tissue was very firm but did not bleed. A partial airway was established by biting it away. It was reported as chronic inflammatory tissue. Breathing was improved, and the patient did not reappear for three years.

Bronchoscopy on May 15, 1945, revealed only slight injection of the larynx and trachea, but the right main bronchus was greatly stenosed for a distance of 1 cm. below the level of the carina, with one central opening and many sieve-like perforations. The left main bronchus was almost completely stenosed about 1 cm. below the carina, with only a slit-like opening remaining. Attempts at biting away this stenotic tissue and dilating the bronchial lumens was repeated with great improvement in breathing until October, 1945, when bronchoscopy revealed stenosis extending into the lower lobe bronchus on the right and into the divisions of the main bronchus on the left.

Bronchoscopy on Jan. 11, 1946, revealed the glottic chink to be stenosed by slight diffuse infiltration. The mucosa over the carina and extending down both main bronchi was markedly thickened but smooth and pale. A clinical diagnosis of scleroma was made at this time, but the biopsy was reported as squamous metaplasia.

Repeated biopsies of the diffusely infiltrated bronchial mucosa were negative for evidence of scleroma, but on April 26, 1946, a biopsy from the thickened mucosa obstructing the left nares was described as presenting a picture highly compatible with that of rhinoscleroma, showing a dense infiltration of plasma cells, many Russell bodies, very many large foam cells of the Mikulicz type, in which even with the H. E. stains bacilli could be seen clustered and surrounded by large vacuole-like capsules.

On May 6, 1946, Klebsiella rhinoscleromatis was identified by culture reactions from nasal smears. A sensitivity test of this organism with streptomycin was made, and treatment was started on May 23, 1946, consisting of one-fourth gram every three hours intramuscularly and one-twentieth of a gram every three hours by nebulizer. Three days later there were no organisms and no growth from smears and cultures taken from the nose. The treatment was discontinued after 10 days when a rash developed on the patient's arms and abdomen. There was marked improvement in breathing.

The patient was not seen again for seven months until Jan. 17, 1947 (during which interval she underwent a normal delivery of her fourth child). On examination the larynx then appeared normal, but the glottis seemed small and tight. The tracheal mucosa was dry but smooth and not infiltrated. The mucosa over the carina and of the main bronchi was slightly thickened but smooth. All bronchial openings seemed narrowed a very little, and there was one vertical pillar of scar-like tissue in the left main bronchus just above its bifurcation. The impression was that the process was not only arrested, but that the bronchi were very much more open than they had ever appeared. Repeated bronchoscopies in March and October, 1947, revealed the bronchi still well open.

The last bronchoscopy was performed on Nov. 26, 1948, at which time the patient complained of slight dyspnea upon exertion. The larynx, trachea and carina appeared normal. The right side of the tracheobronchial tree seemed normal except that all lumens had been narrowed about 10 per cent by mucosa thickening. The left side of the tracheobronchial tree was the same except that the medial wall of the main bronchus had one area about 2 cm. below the carina where the mucosa presented a small granuloma-like nodule and a band of scar tissue.

Case 2: A 26-year-old male alien Mexican itinerant prune and cotton picker, was first admitted to the Los Angeles County General Hospital on Sept. 19, 1946, because of cough and increasing respiratory difficulty for the past four months. Within five days stridor and dyspnea increased so greatly that an emergency tracheotomy was necessary on Sept. 24, 1946. Direct laryngoscopy at this time revealed only slight thickening of the true cords, but there was a large amount of deep red granulomatous-like thickening of the subglottic tissues which bled easily when traumatized by the scope. The mucosa of all of the rest of the trachea was smooth but greatly thickened, so that its lumen was greatly diminished in size. Two days later, examination of the nose revealed granulomatous-appearing tissue on the anterior end of both inferior turbinates and on the right side of the septum anteriorly.

Biopsy taken from the trachea on Sept. 24, 1946, was described as being granulation tissue cover on one surface by epidermoid epithelium and infiltrated with many plasma cells, some of which were vacuolated and others which resembled Russell bodies. Smears taken from the nose on Nov. 4, 1946, were positive for Klebsiella rhinoscleromatis by cultural reaction. Their streptomycin sensitivity test revealed no growth with 1.5 mgm. per milliliter. A sulfadiazine sensitivity test revealed only slight inhibition in a 5 mgm. solution but no complete inhibition in 40 mgm per cent soluton. The pencillin sensitivity test revealed no inhibition in the 100 unit solution. Re-examination at this time revealed the glottic structures to be normal, but the immediate subglottic area and upper trachea was almost completely stenosed by fairly smooth surfaced, deep purple-red infiltration of all of its mucosa.

On Nov. 23, 1946, streptomycin therapy of 1 gm. daily in eight divided doses intramuscularly and half a gm. daily by nebulizer was instituted and repeated for 14 days.

The tracheotomy tube was removed on Jan. 13, 1947, and on Jan. 21, 1947, direct laryngoscopy revealed the larynx to be injected, but the infiltration previously seen subglottically was completely absent. The tracheal mucosa was smooth and only slightly thickened, as its ringed structure could plainly be seen. The tracheobronchial tree was completely normal. The patient was discharged on Feb. 18, 1947, and has never returned.

Case 3: H. P., a 22-year-old Mexican, born in southern California, was admitted on March 5, 1947, in a critical condition. He was cyanotic and had stridor and marked retractions. A history was obtained of increasing respiratory distress for the past four years. Direct laryngoscopy revealed the larynx to be injected, and the true cords slightly thickened, but the glottic chink wide open. The subglottic region was completely filled by a dry crust-covered lesion. Immediate tracheotomy was necessary. Smears and cultures were suspicious for diphtheria and 40,000 units of diphtheria antitoxin were given. Throat cultures remained positive for diphtheria until April 19, 1947. The patient was transferred to the nose and throat

service on April 28, 1947, because of inability to decannulize him. On examination typical odor of ozena was detected. Both naris were completely occluded by foul smelling adherent crusts covering thickened, infiltrated mucosa. Indirect laryngoscopy revealed crusting and dark red thickening in the subglottic area.

On May 16, 1947, tracheoscopy was unsuccessful because of great thickening of the tracheal mucosa covered with crusts, and because of bleeding when the crusts were removed. On May 23, 1947, the mucosa of the trachea, carina and the beginning of both main bronchi were greatly thickened and the bronchial lumens were so stenosed that they could not be entered by the bronchoscope. The mucosa appeared very dry and slightly roughened.

On June 2, 1947, repeated biopsies from the nasal lesions finally were described as consistent with scleroma, in that there was a granulomatous infiltration of the lamina propria characterized by Mikulicz cells, plasma cells and occasional Russell bodies. Bacterial stains showed very many small bacilli within the Mikulicz cells. On June 20, 1947, the bacillus of rhinoscleroma was grown from nasal cultures. A streptomycin sensitivity test revealed no growth in the presence of 0.1 mg. per milliliter of streptomycin.

Streptomycin therapy was started on July 1, 1947. One gram was dissolved in 8 cc. of normal saline, and four doses of 2 cc. each were given intramuscularly each day. A half a gm. in 4 cc. of normal saline was given daily by nebulizer in four divided doses. The treatment was continued for six weeks. At the end of the first 48 hours there were no longer any crusts in the nose and much less crusting in the larynx, but crusting extending into both main bronchi for 1 to 2 cm. had to be removed by bronchoscopy on July 13, 1947. On July 22, 1947, there was very little crusting in the larynx and tracheobronchial tree and the aerosol streptomycin was discontinued. On Aug. 1, 1947, bronchoscopy revealed much less infiltration of the mucosal walls, but there was still some stenosed and some thin, white crusts. The tracheotomy tube was removed at the end of the first two weks of treatment. Treatment was discontinued on Aug. 12, and the patient was discharged on Aug. 15, 1947.

The trachea has remained wide open and there has been slight thin, dry, white crusting of its anterior wall. On Jan. 6, 1948, tracheoscopy and bronchoscopy revealed very little smooth surfaced, slightly irregular thickening of the tracheal mucosa, but no crusting and no abnormal findings in the bronchi. The nose remains full of crusts.

DIAGNOSIS.

From these cases and others that I have seen, it seems to me that scleroma usually involves the larynx subglotically. The true cords may be slightly infiltrated and their movements restricted, but the obstructing lesion and crusting appear below them. Dark purple-red granulomatous masses that bleed easily are usually seen when the crusts present are removed. The lesions are painless, just as in the nose and pharynx. The involvement usually seems to be of the diffuse

infiltrative type and is usually seen by the endoscopist in either the hard granulomatous stage or the later stenotic fibrotic stage. Any part of the trachea, carina and large bronchi may be involved. While the flattened-nodular granulomatous infiltration is frequently seen in the immediate subglottic area, it is the fibrotic stenosing stage that is usually encountered lower down the trachea and in the bronchi. This stenosis causes gradually increasing dyspnea and wheezing. Morrison[7] has reported a patient with scleroma in whom there was great dilation of the main bronchial openings and the lower one-third of the trachea below the lower of two diaphragm-like fibrotic obstructions of the trachea. In the fibrotic stages the mucosa is paler, smoother and harder. In the trachea the lesions are usually concentric. Crusting in these areas is not so great nor so wet as in the nose or other upper respiratory passages. Any stenotic obstructing lesion should be suspected of being scleroma. The diagnosis is difficult to make histologically from the trachea and bronchi because it usually seems to be encountered here in these later stages when the foam cells and bacilli are less numerous. In all of the above three cases the clinical diagnosis of scleroma was proven by obtaining positive biopsies from nasal lesions. Cultures made from secretion swabbed from the scleromatous nasal mucosa after crusts have been removed will usually grow readily and abundantly on all ordinary media. Cultures made from a crushed piece of fresh biopsy tissue are rarely necessary.

TREATMENT.

In the past, treatment consisting of X-ray or radium irradiation, fulguration and chemotherapy[4] has usually given little relief, and the disease has progressed. In these three cases and one reported by New,[8] streptomycin certainly caused sudden dramatic improvement. Not only was there great clearing of the disease process, but most of the improvement gained seems to have persisted. Interestingly, improvement of the nasal lesions present in the same patients was not so great nor so lasting. Maybe larger doses or longer treatment will be the answer. If the lesions do not disappear or greatly

regress with the streptomycin therapy, the only other procedure of value is the repeated biting away of obstructing tissues.

SUMMARY.

Three cases of scleroma of the larynx, trachea and bronchi have been presented. The usual laryngeal lesions appears to be only a slight reddened infiltration of the true cords, but great obstructing granulomatous infiltration of the subglottic area. Scleroma lesions in the trachea and bronchi tend to be of the diffuse concentric infiltrative type of either the firm granulomatous stage or the later fibrotic stenotic stage. The disease should be suspected whenever there is a stenosing obstruction of the trachea and bronchi. If biopsies do not show all of the characteristics of this disease, the diagnosis can many times be proven by biopsies and cultures from the nose. In treatment, streptomycin seems to offer more than anything else used so far.

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THE FENESTRATION OPERATION — INDICATIONS, TECHNIQUE AND RESULTS.*†‡

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With a series of 144 fenestration operations, I propose to offer no contribution to the field of fenestration surgery; I have, however, learned a great deal. I have learned something of the indications for the fenestration operation; this, I hope, will be of interest to every otolaryngologist. I have learned many practical points in the technique which may be of value to others, and I have learned something of the good and the bad results which are to be expected from fenestration surgery.

INDICATIONS.

The fenestration operation is indicated only in moderate degrees of otosclerosis with adequate retained inner ear function. The most critical frequency for determining this inner ear function is at 1024 dv. The 1024 magnesium tuning fork is, to me, the most valuable single test in determining the suitability of clinical otosclerosis for the fenestration operation. If, in clinical otosclerosis, the bone conduction is normal or prolonged with the 1024 magnesium tuning fork, the patient probably is a candidate for the fenestration operation. If the bone conduction is appreciably shortened with this tuning fork, the patient probably is not a candidate for the fenestra-

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‡Illustrated with color movie.

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tion operation. In a busy office practice, without time for detailed and complete hearing tests, this single test is good presumptive evidence of the patient's suitability for surgery.

Detailed and complete hearing tests are necessary for accurate evaluation. It is my practice to make an air conduction audiogram, a bone conduction audiogram (with masking of the opposite ear), to time the duration of the bone conduction and the air conduction with calibrated magnesium tuning forks of the frequencies of 512, 1024 and 2048 dv., and, in addition, to measure the patient's ability to understand the low conversational voice and whisper. These tests are repeated at least twice before surgery.

With the detailed audiogram, correlated with the findings of the tuning forks, otosclerosis may be classified as early, moderate, moderately severe and severe.[1-3]

Early Otosclerosis.

In early otosclerosis, the patient exhibits a flat or ascending audiogram, with hearing at or above the 30 db. level for the speech frequencies of 512, 1024 and 2048. The Rinne test will be negative with the 256 tuning fork; with the 512, the Rinne may be negative; but, with the 1024 and 2048 tuning forks, the air conduction remains longer than bone conduction. The bone conduction is prolonged over normal with the 512, the 1024 and the 2048 tuning forks. The fenestration operation is not indicated in early otosclerosis, for the patient still has useful hearing; further, if the patient still has useful hearing in the better ear, the fenestration operation is not indicated in the more involved ear.

Moderate Otosclerosis.

In moderate otosclerosis (see Fig. 1), the patient exhibits a flat or ascending type audiogram, with the hearing for the speech frequencies of 512, 1024 and 2048 below the critical level of 30 db. The bone conduction is normal for the speech frequencies. The Rinne is now negative with the 512 tuning fork; bone conduction and air conduction are about equal with

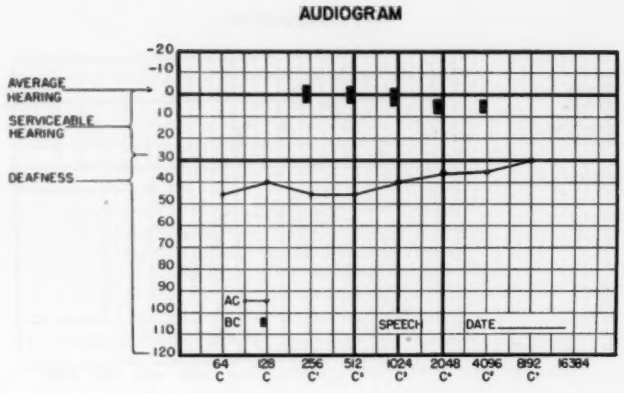

Fig. 1. Moderate otosclerosis presents a flat or ascending air conduction audiogram with normal bone conduction. This is a good candidate for the fenestration operation.

the 1024 tuning fork; and the Rinne remains positive with the 2048 fork. Such patients are ideal candidates for the fenestration operation.

Moderately Severe Otosclerosis.

In moderately severe otosclerosis (see Fig. 2), the patient exhibits a sloping type of audiogram, with a more severe loss of auditory acuity for the higher tone frequencies, indicating loss of cochlear reserve. The bone conduction audiogram is sloping. The bone conduction is still normal at 512. There is slight loss of bone conduction at 1024; but, at this frequency, the bone conduction has not fallen below the 20 db. level. The bone conduction for the frequency 2048 is near the 30 db. level. With the 512 tuning fork, the Rinne is negative and the bone conduction is prolonged. With the 1024 fork, bone conduction

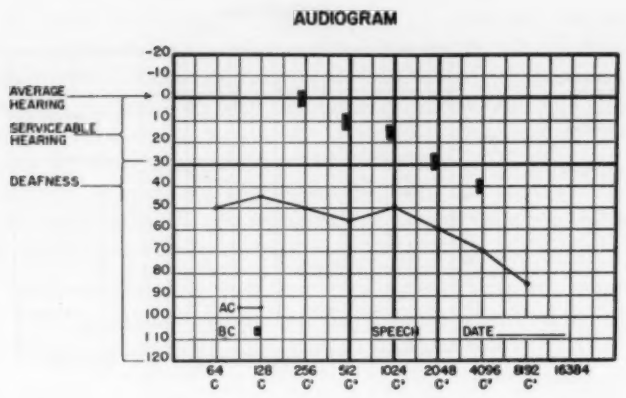

Fig. 2. Moderately severe otosclerosis presents a sloping air conduction audiogram and a sloping bone conduction audiogram, with bone conduction at or above the 20 db. level at the critical frequency of 1024 dv. This is a fair candidate for the fenestration operation.

and air conduction are equal; with bone conduction, normal or prolonged. Air conduction is still greater than bone conduction with the 2048 fork, and bone conduction is shortened with this fork. Depending upon the degree of nerve involvement, these patients are good to fair candidates for the fenestration operation.

Severe Otosclerosis.

In severe otosclerosis (see Fig. 3), the patient exhibits a sharply sloping air conduction audiogram, with a severe loss for the higher tone frequencies, indicating severe loss of cochlear reserve. With the bone conduction audiogram, the bone conduction is still normal or nearly normal at 512. At 1024, the bone conduction has fallen below the critical level of 20

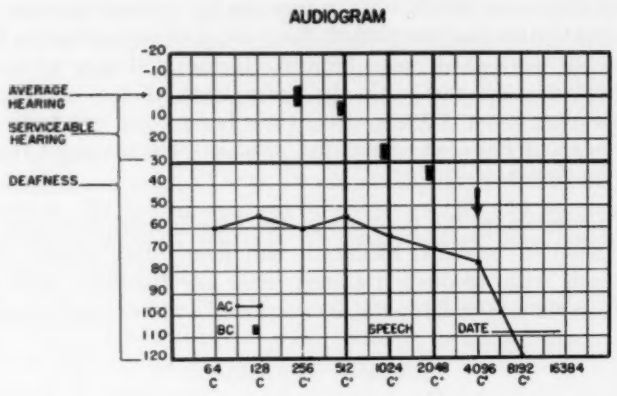

Fig. 3. Severe otosclerosis presents a sharply sloping air conduction audiogram, with bone conduction below the critical level of 20 db. at 1024 dv. This is a poor candidate for the fenestration operation, and I will advise a hearing aid.

db.; and the bone conduction is below the 30 db. level at 2048. With the 512 magnesium fork, the Rinne is negative and the bone conduction is still prolonged over normal. The bone conduction is shortened with the 1024 fork, and the Rinne may now be negative with the 1024 fork. The bone conduction and air conduction are appreciably shortened at 2048, but I have never seen a negative Rinne at this frequency. In severe otosclerosis, the patient is a poor candidate for the fenestration operation, and I will advise a hearing aid.

Tuning Fork Testing.

In performing the tuning fork test, the magnesium fork is preferred to the usual steel fork because of its longer duration of vibration. This prolonged duration of vibration decreases

the margin of error in testing. As previously described, the forks of the speech frequencies of 512, 1024 and 2048 dv. per second are utilized in the preoperative testing of otosclerosis. Each examiner should time in seconds the normal duration of air conduction and the normal duration of bone conduction for his individual set of forks, for these factors will vary with the individual fork and with the noise level of the individual examining room. I know these time factors for my forks in my hearing room and place the greatest reliance upon these tuning fork tests.

To summarize the indications, the fenestration operation is indicated in bilateral moderate and moderately severe otosclerosis with adequate retained inner ear function, particularly as determined for the frequency of 1024 dv. per second.

SURGICAL TECHNIQUE.

Varying from the classical Lempert technique, the following procedures have proven to be of practical value:

1. General anesthesia is preferred.
2. A modified Shambaugh type of incision is used.
3. The flap is elevated before any bone surgery.
4. The antrum is approached directly through the canal wall.
5. The incus is removed as soon as it is accessible.
6. The flap is continuously protected with surgical rayon.
7. The primary skin graft is advocated to prevent postoperative otorrhea.

GENERAL ANESTHESIA.

General anesthesia is preferred to local anesthesia, having advantages for the patient and for the surgeon. From the standpoint of the welfare of the patient, general anesthesia provides more scientific control of the depth of anesthesia, the

occasional discomforts of local anesthesia are eliminated and the postoperative hangover is greatly reduced. From the standpoint of the surgeon, with general anesthesia, the operator may devote his uninterrupted attention to the minute perfection of surgical technique without the interrupting annoyances of local anesthesia. With general anesthesia, as compared to local anesthesia, bleeding during the operation is the same, or less, and the hearing improvement is the same. The type of general anesthesia used is intratracheal nitrous oxide and oxygen, combined with intravenous pentobarbital sodium narcosis. When administered by a well trained and competent medical anesthetist there is no concern about the patient's general welfare.

For my first 100 fenestrations, the anesthetic routine was the Banower heavy barbiturate sedation and morphine, supplemented with local infiltration with 1 per cent novocaine and the topical application of 10 per cent cocaine in the middle ear (utilized in 86 of the 100 cases). At the completion of the series, I felt that this was the method of choice. On moving to Tampa, Dr. Carron prevailed upon me to try general anesthesia. This has been used in 41 consecutive cases. A comparison of the operative statistics on these two series, considering the quality of the anesthetic, the bleeding during the operation, the postoperative course and the end-result, has convinced me to continue utilizing this method.

The quality of the local anesthesia in the 86 cases was classed as good in 62, fair in 10, poor in three, and no good in 11, requiring delayed supplemental intravenous pentothal. In the 41 cases with general anesthesia, the anesthetic has been uniformly good.

The bleeding during the operation with local anesthesia alone was classed as minimal in 46, annoying in 26, severe in three. The bleeding during the operation with local with delayed supplemental pentothal was classed as minimal in four, annoying in four, and severe in three. The bleeding in general anesthesia has been classed as minimal in 32, annoying in nine, and severe in none. Summarizing this comparison,

bleeding was significant in 41.9 per cent of 86 cases with local (or local with delayed supplemental pentothal), while bleeding was significant in 21.9 per cent of 41 cases with general anesthesia. This comparison should be qualified by one change in surgical technique; in the 41 cases under general anesthesia, the flap has been turned prior to any bone surgery to allow time for the canal bleeding to stop before opening the labyrinth.

The postoperative course has been more placid in patients with general anesthesia. The patient responds before leaving the operating room. The patient will occasionally sit up on the afternoon of the operation. The patient is usually out of bed, with assistance, on the first or second postoperative day. The nausea, vomiting and vertigo are reduced.

The elimination of the use of topical cocaine in the middle ear may be a factor in reducing the nausea, vomiting and vertigo. In 1946, I presented my experience with tympanosympathetic block (relative to tympanosympathectomy for tinnitus), whereby 0.5 cc. of 10 per cent cocaine was instilled into the middle ear to determine the effect upon tinnitus. When this was done, the cocaine was absorbed into the inner ear. The patients (three in number) became violently dizzy; very severe nausea, vomiting and vertigo lasted six to 10 hours; and the patients were miserable on the next day. Yet, instilling 10 per cent cocaine into the attic and middle ear is routine with local anesthesia for fenestration. If cocaine is to be used in fenestrations, it should not be instilled, but should be applied on applicators.

The postoperative hearing restoration has been the same in general and local anesthesia. It is interesting to note that of my five early closures of the fenestra, three occurred when the local anesthesia was a problem. Admitting human failings, it may have been that the diversion of my attention from the surgical perfection of the technique to the anesthetic problem was responsible for some technical imperfection. Under gen-

eral anesthesia, the operation is not interrupted by the vomiting, straining or crying patient, and the surgeon's attention is devoted entirely to the minutely accurate surgical technique.

INCISION.

To avoid stenosis of the auditory canal and to aid in the epithelialization of the cavity, I have utilized a modified type of Shambaugh[4] incision, preserving all of the skin of the canal and removing the subcutaneous tissue and periosteum.

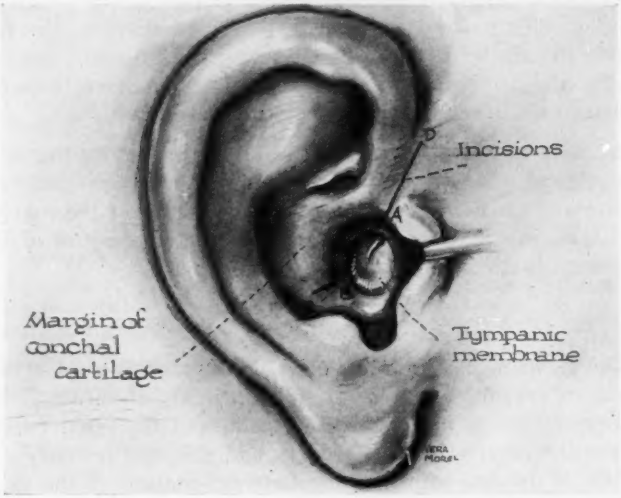

Fig. 4. The endaural incision, A,B,C-A,D, preserves all the skin of the canal. The subcutaneous tissue is excised and discarded, and the resultant flap protects the margin of the conchal cartilage and prevents stenosis of the auditory canal.

The incision is begun at point A (see Fig. 4) at 12 o'clock, at the junction of the inner two-thirds with the outer one-third of the auditory canal. At the same depth in the canal, the incision is carried from 12 o'clock around the posterior rim of the canal to 7 o'clock in the right ear (5 o'clock in the left ear). The incision is then downward and outward to the rim of the cymba conchae. The second, or vertical, incision begins

at the original point A, at 12 o'clock, and is carried vertically upward, through the subcutaneous tissue and periosteum to the rim of the temporal muscle; then, superficial to the temporal muscle, between the helix and the tragus, as in the Lempert[5] incision. The skin and periosteum are then elevated from the cortex of the outer portion of the bony wall of the auditory canal and from the adjacent mastoid. The pedicle thus created is grasped at its inner extremity with the Allis forceps and the epithelium elevated from the subcutaneous tissue. The subcutaneous tissue is excised along the margin of the conchal cartilage and the inferior border of the temporal muscle. This tissue is discarded. The epithelium of the flap covers the rim of the conchal cartilage and prevents stenosis of the auditory canal. This incision is little more than the endaural modification of the classic Koerner flap.

At the termination of the operation, the upper two-thirds of the vertical incision is closed with a single vertical mattress suture and the flap is tucked around the border of the conchal cartilage, where it is held in position by the pressure of the rayon synthetic sponge packing (see Fig. 9).

PRIMARY ELEVATION OF THE TYMPANOMEATAL FLAP.

The tympanomeatal flap is elevated, thinned and cut before any bone surgery (see Fig. 5). This primary elevation of the flap permits time for absolute hemostasis of the canal vessels before the labyrinth is opened. In addition, the primary elevation of the flap affords immediate orientation of the slope of the canal wall and the position of the notch of Rivinius.

Before the self-retaining retractor is inserted, the skin of the anterior canal wall is incised 3 mm. external to the bony canal and extending upward into the vertical incision. This incision provides better exposure over the zygoma without tension on the tympanomeatal flap. The tympanomeatal flap is then elevated. Incisions are made from the annulus tympanicus, outward, at the posteroinferior and the anteroinferior angles of the canal. As pointed out by Shambaugh,[6] the cutaneous lining of the anterior wall of the canal provides the

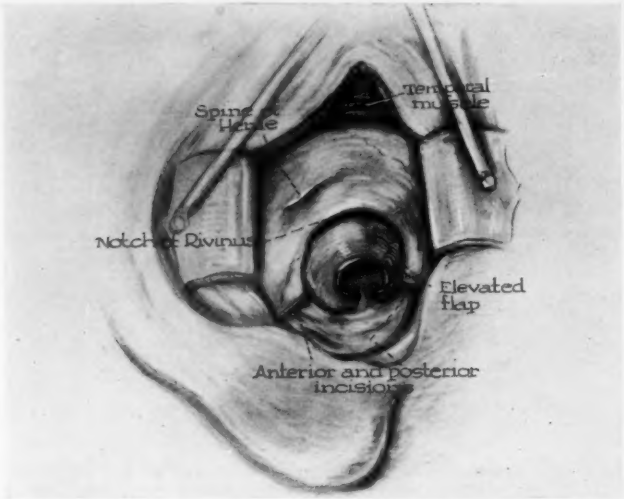

Fig. 5. The primary elevation of the flap permits time for absolute hemostasis of the canal vessels before the labyrinth is opened and permits the direct approach to the mastoid antrum.

thinnest possible covering for the fenestra. The excess of subcutaneous tissue is removed from the peripheral portion of the flap. The entire exposed surface of the flap is covered with a layer of surgical rayon.* This protective covering of rayon protects the flap from any bone dust or bone spicules, and from the surgeon.

THE DIRECT ATTICOANTROTOMY.

The primary elevation of the tympanocutaneous flap permits the direct approach to the mastoid antrum through the thin bony wall of the auditory canal (see Fig. 6). When the mastoid and the zygoma are pneumatic, the cortex of the outer two-thirds of the superior and the posterior bony walls of the auditory canal and the adjacent mastoid cortex over the antrum are removed simultaneously. This direct approach to

*Owens Surgical Fabrics, Hamilton Mills Division, Winchester Mills, New York, N. Y.

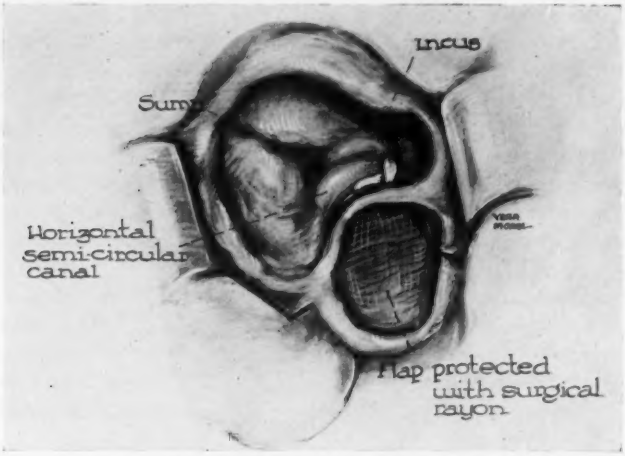

Fig. 6. The direct atticoantrotomy is accomplished by the simultaneous removal of the cortex of the outer two-thirds of the bony canal wall and the adjacent mastoid cortex.

the antrum and attic discards the Schwartze technique of preserving the bony canal and approaching the attic from behind. In this technique, the flap is protected by the surgical rayon rather than the bony wall of the canal. The sole purpose of the atticoantrotomy is to create adequate exposure of the site of the fenestra and to provide a cavity which is easily cleaned. Formerly, all mastoid air cells were exenterated; this created an unnecessarily large cavity and frequently delayed healing. To facilitate healing, the present trend is to create only an atticotomy, as advocated by DeLima[7] and adapted by Shambaugh;[6] this small cavity has advantages, but the surgeon should always create enough room to avoid cramping his individual surgical technique.

EARLY REMOVAL OF THE INCUS.

Having opened the antrum and removed the external wall of the attic, the incudomalleolar articulation its exposed. The incus is removed as soon as the exposure will permit (see Fig. 7). The early removal of the incus permits the maximal

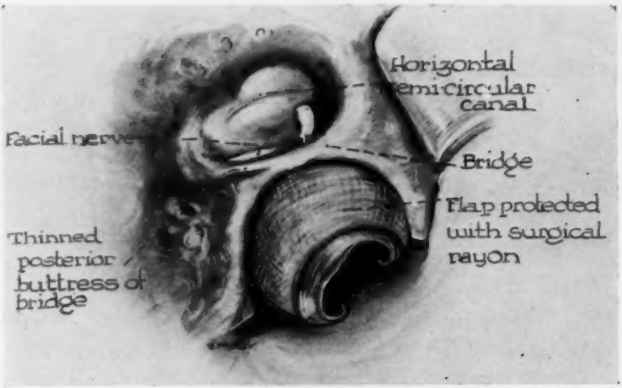

Fig. 7. The early removal of the incus permits maximal thinning of the bridge and the posterior buttress of the bridge with the surgical burr.

thinning of the bridge and the posterior buttress of the bridge with the surgical burr. In thinning the bridge, to prevent "running" of the burr toward the flap, the burr should always rotate in a superior direction (counterclockwise in the right ear and clockwise in the left ear). With the burr coursing over the horizontal canal, the posterior buttress of the bridge may be thinned from above down to the level of the corda tympani nerve and on a plane with the vertical course of the facial nerve. With the Lempert rongeur, a bridge so thinned may be removed posteriorly to the plane of the vertical course of the facial nerve.

THE FENESTRA.

The contour and the accurate debridement of the fenestra are the *sine qua non* of fenestration surgery. As pointed out by Lempert,[9-11] the fenestra should be placed on the elevated ampulla of the horizontal canal (see Fig. 8). The endosteal margins should be sharp, the endosteum should not be traumatized and all endosteum and osteogenic endosteal bone dust should be removed. Toward this goal, I continue to use the burr only under irrigation to remove the osteogenic bone dust, to create a wide elevated blue ovoid at the site of the fenestra,

Fig. 8. Stretching the flap posteriorly, parallel to the fenestra, the adjacent under surface of the flap is accurately debrided (all osteogenic bone spicules removed).

to pulverize the endosteal bone with the polishing burr, to polish the margins of the fenestra with the gold burnishing burr and to debride the margins of the fenestra with the Shambaugh picks.

THE TYMPANOCUTANEOUS FLAP.

I want to make five points relative to the flap: First, as has been previously stated, the flap is continuously protected with a layer of surgical rayon whenever any bone surgery is in progress. This surgical rayon prevents bone dust and bone spicules from accumulating on the undersurface of the flap and makes debridement of the flap a more certain and less arduous task. Further, the surgical rayon prevents a film of coagulated blood from accumulating on the undersurface of the flap.

Second, in the elevation and the subsequent manipulation of the flap, it is always treated with the greatest delicacy, agreeing with Day[8] that the less the flap is traumatized, the

less will be the postoperative edema of the flap and postoperative labyrinthine reaction. To minimize the trauma, the flap is never touched with the suction but only with the moistened cotton applicator to which the suction is applied.

Third, as all authors have stressed, the undersurface of the flap is searched for any attached osteogenic bone spicules or bone dust which would rapidly occlude the fenestra. In the debridement of the flap, all such osteogenic particles are removed.

Fourth, after the fenestra has been completed, the folded flap is stretched posteriorly, parallel to the fenestra (see Fig. 8), and that portion of the flap which is to cover the fenestra is again searched and any osteogenic spicules removed.

Fifth, the anterior attachment of the flap is not cut free from the anterior portion of the annulus tympanicus until the fenestra is complete, to avoid shredding of this delicate skin of the anterior wall of the canal. The cavity is then thoroughly irrigated and the flap floated into position over the fenestra. The flap is covered with a protective layer of surgical rayon. The flap and the rayon are held in position over the fenestra with two small pledgets of synthetic sponge. The sponge should be gently pressed over the fenestra; for, if the packing is placed tightly over the fenestra, there will be ischemia of the flap and, when the packing is removed, there will result secondary hyperemia and labyrinthine reaction.

THE PRIMARY SKIN GRAFT.

The denuded area in a fenestration cavity may vary from 6 to 18 sq. cm. Illustrated mathematically, a cavity 1 cm. in diameter and 2 cm. deep has a side wall surface of 6.2832 sq. cm.; a cavity 2 cm. in diameter and 2 cm. deep has a side wall surface of 12.5664 sq. cm.; while a cavity 3 cm. in diameter and 2 cm. deep has a side wall surface of 18.8496 sq. cm. Such denuded areas are exposed to infection for the weeks or months required for spontaneous epithelialization. I have,

therefore, adopted the routine application of a primary skin graft to facilitate healing of the fenestration cavity and to prevent the annoying postoperative otorrhea.

As described in detail for the radical mastoidectomy,[12] the ear and the donor site are aseptically prepared and the graft taken before the ear surgery is begun. At the completion of the fenestration operation, with the flap held in position with rayon and synthetic sponge, the remainder of the cavity is lined with the split thickness skin graft. To make the skin more manageable, it is backed with surgical rayon and cut in pattern to line the cavity. The skin and surgical rayon (see Fig. 9) are held in position with synthetic sponge packing for seven days.

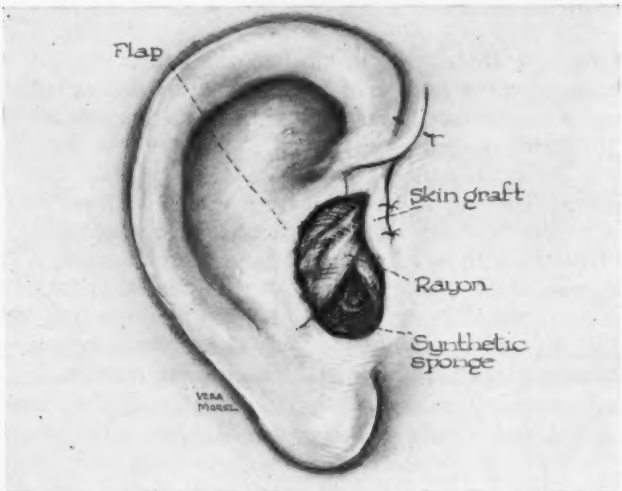

Fig. 9. The denuded fenestration cavity is lined with a primary split-thickness skin graft which is held in position by rayon and synthetic sponge packing.

COMPLICATIONS.

In this series, there have been no serious complications and no deaths. One patient (an incidence of 0.7 per cent) developed a transient facial paralysis which lasted from the eighth

to the twenty-first postoperative day; this was temporarily humiliating but of no permanent consequence. One patient developed a perichondritis, which subsided on penicillin therapy.

Slight, insignificant dizziness on sudden motion, blowing of the nose, movement of the ear or using cold ear drops is not an infrequent symptom following the fenestration operation; however, patients do not express this symptom as a complaint. Significant vertigo has persisted in three, or 2.1 per cent of patients. In one of these, there is a recurrent area of granulation on the anterior border of the flap. The other two patients who complain of vertigo occurred in a series of seven patients in whom the head of the malleus was left in position.

The greatest single nuisance factor in fenestration surgery is the annoying postoperative otorrhea. This may last for months or years. In general, in my office and throughout the country, these postoperative fenestration cavities are overtreated. Time is more important than local treatment in the epithelialization of these denuded areas.

Scant otorrhea requires no local office treatment. The patient may cleanse the canal and report to the office once or twice a month for inspection of the cavity. Unnecessary swabbing of these cavities may destroy the epithelial margins.

When there is moderate otorrhea and no excess granulation tissue, the cavity should be kept from debris with a cleansing ear drop. I utilize glycerite of hydrogen peroxide with barbamide or one of the ear drops containing urea, glycerine and sulfa suspension. Again, the patient reports to the office once or twice a month for inspection of the cavity. When the excess discharge subsides, the ear drops are discontinued.

When inspection of the cavity reveals exuberant granulation tissue and there is no drug sensitivity, more active local treatment is necessary. If the infection is in the acute phase, it may respond to penicillin in saline ear drops or packing the cavity with fine mesh gauze soaked in penicillin and saline. Chronic granulation tissue should be removed with the Coak-

ley curette and the base of the granulations cauterized. I preventing the recurrence of these granulations, I have run the gamut of all forms of local therapy and have reverted to the practice of the early otologists and pack these cavities tightly with heavily lubricated vaseline gauze packing. Replacing this packing one, two or three times weekly for two or three weeks will frequently result in complete healing of an otherwise refractory cavity.

This otorrhea is most annoying to the patient in the first postoperative months. In the 100 cases who are now more than one year postoperative, nine record slight discharge and three complain of marked discharge.

IMMEDIATE RESULTS.

Analysis of 100 consecutive fenestration operations (Cases 19 through 118, inclusive) reveals that the operation was at

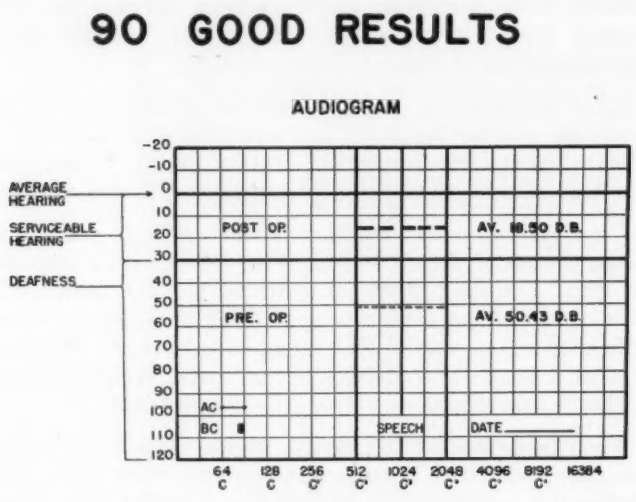

Fig. 10. Of 100 consecutive fenestrations, 90 patients obtained at least temporary good hearing.

6 FAIR RESULTS

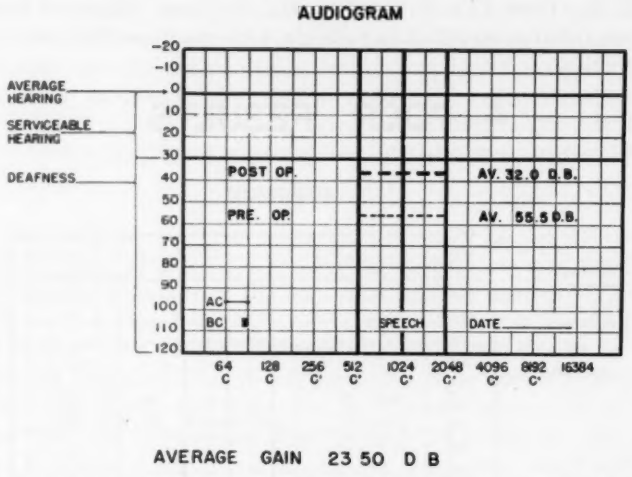

Fig. 11. Of 100 consecutive fenestrations, six additional patients obtained at least temporary useful hearing improvement.

least temporarily successful in 96 patients and a failure in four patients. Of the 96 rehabilitated patients, there were 90 good results and six fair results. The 90 good results (see Fig. 10) had the hearing restored to the serviceable level, an average postoperative level of 18.5 db. on their best audiogram. These patients had an average gain of 31.93 db. from an average preoperative hearing level of 50.43 db. for the speech frequencies. This improved their ability to understand low conversational voice from an average preoperative distance of 4.3 inches to an average postoperative distance of 196.3 inches. The six fair results (see Fig. 11) had hearing improved to the 32 db. level on their best audiogram. These patients had an average gain of 23.5 db. from an average preoperative level of 55.5 db. This improved their ability to understand low conversational voice from an average preoperative distance of 2.6 inches to an average postoperative

distance of 68 inches. These patients are able to conduct their affairs without the use of a hearing aid. The four poor results (see Fig. 12) had an average postoperative hearing loss of 7.7 db., from 57.5 db. level to 65.2 db. level. Three of these four failures occurred in patients with questionable inner ear function.

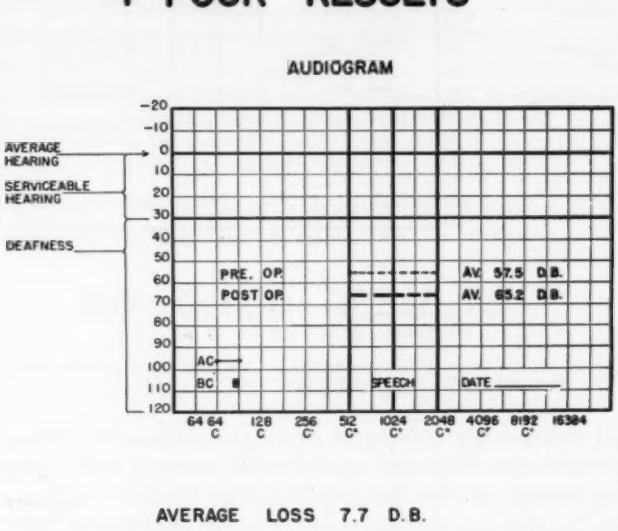

Fig. 12. Of 100 consecutive fenestrations, there were four poor results.

LASTING RESULTS.

Hearing maintained at a constant level for a period of one year is regarded as a statistically reportable lasting result. In this series there are 91 patients (of the first 100 fenestrations) who regained serviceable hearing and who are now 12 to 33 months postoperative. Of these 91 patients, 82, or 90.1 per cent, have retained useful hearing. As previously reported,[2] 85 of these patients received initial good results, with an average maximum gain of 30.9 db. for the speech frequencies, attaining the average postoperative hearing level of 19.4 db.;

six of these patients received initial fair results, with an average maximum gain of 16.8 db., to attain an average postoperative hearing level of 33.8 db. There are seven closures of the fenestra and two patients who have appreciated some loss in auditory acuity and are charted as closures. As current audiograms are not available, this report is not accurate for research purposes; however, in reply to a current questionnaire, the patients state that they have useful hearing which has been a gratifying improvement over the preoperative level of deafness.

Dividing the first 100 cases into groups of 20, on the basis of the questionnaire, it is interesting to note the consistencies of the shortcomings of the operation and my individual technique. In Group I, now 26 to 33 months postoperative, 75 per cent now have useful improvement. In Group II, 20 to 26 months postoperative, 90 per cent now have useful improvement. In Group III, now 18 to 20 months postoperative, 80 per cent now have useful improvement. In Group IV, now 16 to 18 months postoperative, 80 per cent now have useful improvement. In Group V, now 12 to 16 months postoperative, 85 per cent now have useful improvement.

It is interesting to note that 77 patients complained of head noises before surgery; in reply to the questionnaire, 12 to 33 months postoperative, these head noises have now disappeared in 19, are less in 38, are unchanged in 16 and are worse in four; or improved over preoperative in 74 per cent.

AUDITORY TRAINING.

The rehabilitation of the patient is the primary purpose of the fenestration operation. The fenestration operation can restore serviceable hearing but not perfect hearing. Audiometrically, equal hearing may be serviceable in one patient and unserviceable in another; the difference is in auditory training. Auditory training teaches the patient to obtain the maximum utilization of the regained hearing.

Training in speech reading will improve the value of the restored hearing. With a few words of guidance, practical aural rehabilitation may be accomplished in the home. The patient is instructed to have someone read to him for 30 minutes every day and to watch the reader's facial expressions. My patients are instructed never to read their favorite section of the daily newspaper but to have it read to them. The editorials and the columnists which develop a thought are ideal reading for auditory training, while the staccato style of Walter Winchell is worthless. After a few readings in a silent room, the lessons are continued with the radio turned on to provide background noise. In this way, the patient learns to interpret speech in the presence of noise and confusion. Although the majority of fenestrated patients can get along without speech reading, this routine auditory training will help the minority to utilize their borderline hearing.

When the fenestration operation is not indicated or when the fenestration operation is a failure, the patient must rely upon the hearing aid. To utilize a hearing aid satisfactorily, the patient must become accustomed to amplified sound in the presence of background noise. Such patients are required to use the aid in listening to their favorite radio programs, daily, and are encouraged to attend the movies. When the ear has become accustomed to interpreting amplified sound, background noise is introduced. In the home, the kitchen radio is brought into the living room and turned on some other program. In the presence of this background noise, the patient continues to listen to the favorite radio program over the living room radio. In this way, the patient adjusts to the interpretation of amplified sound in the presence of background noise. He then proceeds to speech reading lessons in the presence of background noise. When the adjustment is complete, the patient may wear the aid on the street and in noisy rooms without becoming confused.

Auditory training in the home provides maximum rehabilitation of the patient whether the surgical result has been good, fair or poor. This auditory training has not, however,

altered the statistical results presented in the preceding paragraphs. Combining that which the patient can hear with that which he can see gives the patient every possible benefit from the hearing restoration.

COMMENT.

In properly selected patients, a properly performed fenestration operation is relatively free from any serious risk, the operation is usually successful and the hearing is usually maintained. The greatest single nuisance factor in fenestration surgery is the persistent otorrhea; the primary skin graft reduces this nuisance.

Regardless of decibels and statistics, the end-result to the patient will secure the future of fenestration surgery. Realizing the psychological factors and the shortcomings of subjective methods of interpretation of results, the personal comments of these patients with semimature fenestra is overwhelming documentary evidence in favor of fenestration surgery. With the exception of one psychotic patient and one intermittently vertiginous patient, all others classified as fair or good results express profound gratitude for the benefits of fenestration surgery. The failures, the minority group, have, after a period of depression, adjusted to their handicap and utilized other auditory aids.

At the present time, of the first 100 fenestrations which are not semimature, at 12 to 33 months postoperative, the best I can hope for is 82 per cent with maintained useful hearing, satisfactory to the patient. A few others may be expected to lose their hearing during the second year. This means that, of the first 100 cases, I have had nine immediate failures and nine that have closed or apparently will close. The percentage of immediate failures is largely dependent upon the preoperative quality of the patient's inner ear function. The percentage of closures is dependent upon the quality of the surgeon's technique, as the greatest number of variables are controlled by the surgeon. It is only human to blame failures on the shortcomings of the operation itself. We are at present in the

heyday of fault-finding with statistical reports of results of the fenestration operation; the theme of this period is to blame all failures on the shortcomings of the operation. This is erroneous. If one patient will and one patient will not maintain hearing, the responsibility for the closure must rest squarely upon the surgeon. My nine closures or apparent closures can only be the result of some imperfection of my technique, in the individual case. In some one of the many potential sources of error, I have slipped up and either overdone or left undone. Possibly, with more careful debridement of the flap, more meticulous fenestration technique and possibly with the coupoula and lead burr, I can minimize these human shortcomings.

SUMMARY.

1. The indications for the fenestration operation are outlined; otosclerosis being classified into early otosclerosis, moderate otosclerosis, moderately severe otosclerosis and severe otosclerosis.

2. The fenestration operation is indicated in moderate or moderately severe otosclerosis.

3. A modified Shambaugh incision is presented to preserve all possible epithelium, to aid in epithelialization of the cavity and to prevent stenosis of the auditory canal.

4. Primary elevation of the flap is advocated to permit direct access to the mastoid antrum and to permit complete hemostasis of the canal vessels.

5. Direct approach to the mastoid antrum through the auditory canal is advocated.

6. Early removal of the incus is advocated to permit thinning of the bridge with the surgical burr.

7. Protection of the flap with surgical rayon and thorough debridement of the flap is advocated.

8. Rayon and synthetic sponge packing is advocated to maintain continuous pressure over the fenestra.

9. Persistent otorrhea is the greatest single nuisance factor in fenestration surgery. The primary skin graft of the fenestration cavity is advocated to facilitate primary healing.

10. The technique of home aural rehabilitation is described to aid the fenestrated patient.

ACKNOWLEDGMENTS.

I acknowledge my indebtedness to my teachers, Julius Lempert, James H. Maxwell, Philip Metzer, George M. Shambaugh, Robert Moorhead and others. Their teachings are incorporated in this paper.

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BACTERIAL ALLERGY AND THE IMPORTANCE OF OTOLARYNGOLOGICAL PROCEDURES.*

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Introduction: The existence of hypersensitiveness to bacteria, fungi and viruses is now a more or less accepted fact. Every infection in man, unless it is a fulminating hematogenous affair, or occurs as a terminal event in a cachectic person, leads first to a state of hypersensitiveness to the bacteria which is then replaced, in certain instances, by temporary or permanent immunity. It is beyond the scope of this paper to discuss the still controversial interdependence of allergy and immunity.

The mechanism by which bacterial allergy develops is still a subject of argument. Some investigators[1] believe that bacterial hypersensitiveness depends upon a specific antibody and that the antibodies are so closely bound to the cells that they cannot accumulate in sufficient excess in the circulation to permit passive transfer tests. Other students state that a specific allergic mechanism is the basis of the delayed inflammatory reactions, and that these reactions are characteristic of infectious allergies.[2] The presence of infectious tissue is then conceived to be an essential prerequisite for the production of bacterial allergy. This is a viewpoint which is most attractive to me, and which dovetails with many of the observations made in this report. Recent investigations have shown, furthermore, that bacterial hypersensitiveness can develop in individuals who will not manifest any clinical evidences of bacterial allergy and remain apparently healthy.[3]

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It is apparent, then, that bacterial allergy can develop from overt infections, from the absorption of bacterial substances, or from the production of bacterial products anywhere in the body.

The nature of the bacterial allergen is also a matter of argument and speculation. A workable hypothesis is perhaps that of Zinsser, who stated, "Bacterial allergy is a hypersensitiveness to the somatic protein antigens of bacteria, in which the cells become sensitized by the liberation of an unchanged protein bacterial substance in the lesions."

In this report we shall confine ourselves to the allergy which, we believe, develops from infections in the upper respiratory tract. Although careful aerobic and anaerobic cultures were made from the infected material obtained from the various foci, no attempt is made to denounce any one micro-organism or groups of micro-organisms as the responsible agent. The reason is that the methods available to prove such a causative relationship are still grossly inadequate when we deal with the ordinary pathogenic bacteria. In our experience, skin tests to filtrates or vaccines made from such organisms have proven very disappointing, and the results of such tests were in no way commensurate with the degree of the existing bacterial hypersensitiveness. This applies also to nonpathogenic airborne bacteria, although with the latter, skin tests seem to be more reliable;[1] furthermore, the efficacy of vaccine therapy will not be assayed in the group of patients. It should be stated, however, that a great number received vaccines prepared from organisms obtained from the surgically removed infected material.

Material: This group comprises 911 patients who were studied in the hospital or outpatient clinics during the past 18 years. Many more patients could be included, but the report is limited to those whom we were able to follow for at least five years after the necessary surgical procedure had been instituted. It is needless to say that it was the cooperation of Dr. W. W. Eagle and his staff that so greatly facilitated the handling of these patients. To further facilitate

matters, this group of 911 patients has been broken down into five categories; namely, those who were essentially asthmatics, those patients who suffered from atopic, allergic or perennial rhinitis, and those who sought relief from either urticaria or angioneurotic edema. It is obvious that several of the patients were sufferers from more than one of the common major allergic disorders, but they are classified according to their main presenting complaint.

Asthma: This group comprises 355 patients, ranging in age from seven years to 65 or more years. The incidence of otolaryngological complications is tabulated below:

TABLE 1. ASTHMA.

No. Pats.*	Age (Yrs.)	Nose and Throat Complications No	Yes	Type	No.	Per Cent
15	7-15	9	6	Tonsillitis and adenoiditis	4	
				Sinusitis, ethmoid	1	40
				Sinusitis, antral	1	
58	16-25	35	23	Tonsillitis and adenoiditis	5	
				Sinusitis, single	7	
				Sinusitis, multiple	3	
				Polyps, nasal	5	39
				Polyps, antral	2	
				Polyps and sinusitis	2	
				Recurrent bronchitis	10	
159	26-45	91	68	Tonsillitis and adenoiditis	20	
				Sinusitis, single	18	
				Sinusitis, multiple	26	
				Polyps, nasal	18	42
				Polyps, antral	16	
				Polyps and sinusitis	19	
				Recurrent bronchitis	52	
123	46-65	28	95	Sinusitis, single	12	
				Sinusitis, multiple	43	
				Polyps, nasal	26	
				Polyps, antral	37	77
				Polyps and sinusitis	38	
				Recurrent bronchitis	93	
355			192			55

*Unselected consecutive ambulatory or hospitalized patients.

Although the number of patients in the prepuberty age is small, it is apparent, and in agreement with most clinicians,

that tonsillitis and adenoiditis are the most common offenders. As the patients grow older, complications such as sinusitis, with or without polyposis, and recurrent tracheobronchitis become more frequent. In 159 young adults, single or multiple sinusitis occurred in 44, and recurrent tracheobronchitis in 52 patients. It has been said that an allergic sinusitis is usually multiple, whereas a pyogenic (suppurative) sinusitis often affects only one of the paranasal cavities.

The importance of chronic and acute sinus infections in asthma and tracheobronchial-pulmonary infections has been repeatedly emphasized.[5-8] There is no question that sinus infection is common in many asthmatics and that it undoubtedly plays an important rôle in the infective (allergic) type of asthma. This may well apply also to the incidence of recurrent tracheobronchitis,[10,11] and, through sensitization of the pulmonary alveolar cells to the more obscure types of allergic pulmonary responses, such as Loeffler's syndrome.[12] The incidence of nose and throat complications bears a definite relationship to the duration of asthma in a given patient. This is shown in the following table:

TABLE 2. RELATION OF THE DURATION OF ASTHMA TO THE INCIDENCE OF NOSE AND THROAT COMPLICATIONS.*

Duration of Asthma in Years	No. Pats.	No. Pats. with N & T Complications	Per Cent
1-5	43	11	26
6-10	134	44	31
11-15	91	74	81
16-20	49	37	80
21-35	38	29	76

*Deflection of the nasal septum is excluded as a complication.

It is, of course, difficult to state unequivocally which preceded the other. The fact remains that in our group of asthmatics with nose and throat complications the highest incidence of such infections was observed in those patients who had suffered from asthma for more than 10 years (80

per cent). This does not imply, of course, that three out of four patients who have suffered from asthma for more than 10 years will necessarily be afflicted by infections in the paranasal sinuses or upper respiratory tract.

Of these groups of 355 asthmatic patients, 192 had some type of rhinological or bronchial infection. Of these, 152 patients were subjected to some form of operation, ranging from the submucous resection of the nasal septum to a Caldwell-Luc operation, single or bilateral, on the antral sinuses. The incidence of nose and throat complications and of surgical interference in this group may seem high, but it should be emphasized that the department of allergy and the otolaryngological department at Duke Hospital work in such close cooperation that the study of an asthmatic or any other allergic patient is not considered complete until a nose and throat surgeon has examined the patient.

The effect of the operative procedures in the 152 asthmatic patients is influenced by the duration of asthma as summarized in the third table:

TABLE 3. SUMMARY OF THE RESULTS OF NOSE AND THROAT OPERATIONS IN ASTHMATIC PATIENTS.

No. Pats. with N & T Disease	No. Pats. Operated Upon	Results Good (+)	Improved (?)	Failure (0)	Per Cent Benefited (+, ?)
Group A (1-5 Yrs.)	9	5	4	—	100
Group B (6-15 Yrs.)	105	57	16	32	70
Group C (16-35+ Yrs.)	38	17	10	11	73
Totals	152	79	30	43	69

This is, perhaps, in accord with what has been stated previously, namely the incidence and extent of the nose and throat complications is greater in patients who have suffered from asthma for a long time. A number of the patients had more than one operation (A, B, C). A relatively small group[11] had suffered from asthma less than five years, and the result of surgery in these patients can be described as excellent.

The largest group (118 patients) had been asthmatics for from six to 15 years, and of these, 40 were not improved, whereas the rest (78) were strikingly or definitely benefited. The group of patients (66) who had been asthmatics for more than 16 years showed a higher percentage of failures following surgical interventions. It is, of course, difficult to evaluate beneficial results. This depends on the interpretation of the observer and the relative statistics will necessarily vary with the reports of different clinics. Our criteria in the younger patients were the days lost from school because of asthma or recurrent upper respiratory infections, their ability to exercise and to participate in athletics; and in the older patients, the frequency of asthmatic seizures, head or chest colds, breathlessness and the degree of pulmonary reserve as indicated by the chest expansion, vital capacity and expiration time. Although no accurately measurable data were possible, our clinical evaluation of the efficacy of nose and throat operations in the asthmatic group summarized below:

TABLE 4. RELATION OF THE DURATION OF ASTHMA TO THE EFFECT OF OPERATIVE NOSE AND THROAT PROCEDURES.

Duration (Yrs.) No. Pats. with N & T Disease	Operative Procedures	No. Pats. Treated	No. of Operations	Results 0	?	+
1-5	T & A	A-5	5	—	2	3
(11)	*T & A and					
A	Caldwell-Luc	2	2	—	—	2
	Submuc. Resc.	1	1	—	1	—
	Submuc. Resc. & Ethmoidec.	1	1	—	1	—
	Submuc. Resc. & T & A	A-2	2	—	—	2
6-15	T & A	B-25	25	7	2	16
(118)	T & A +					
	Caldwell-Luc	B-8	8	—	2	6
	Submuc. Resc.	20	20	7	2	11
	Submuc. Resc.	B-4	4	—	1	3
	Submuc. Resc. + Caldwell-Luc	29	29	9	2	18
	Submuc. Resc. + Caldwell-Luc	B-20	20	8	6	6
	Caldwell-Luc	31	31	9	10	12
16-35+	T & A	2	2	—	2	—
(66)	Submuc. Resc.	C-19	19	6	5	8
C	Submuc. Resc. + Caldwell-Luc	C-14	14	3	4	7
	Submuc. Resc. + Ethmoidec.	8	8	2	2	4
	Caldwell-Luc	9	9	3	1	5
Totals: 195		152	200	54	43	103

*Includes polypectomies and sphenoidectomies in many instances.

It was our impression that 69 per cent of the 152 asthmatic patients who were subjected to rhinological procedures were benefited. As already stated, the great majority of these patients received, also, injections of an autogenous vaccine, and there is little doubt that vaccine therapy is efficacious, not only in treating allergic bacterial pulmonary disease,[4,13] but perhaps also in certain instances of sinusitis.[14]

Bronchoscopy has been used by us rarely as a therapeutic measure, but frequently as a diagnostic aid. Undoubtedly it may prove beneficial in certain instances of asthma.[15]

Allergic Rhinitis: This group comprises those patients whose nasal symptoms were due not only to an evident demonstrable inhalant, contact or ingestant allergy, but also in whom a bacterial type of allergy was strongly suspected by history. In many of these patients pathogenic organisms, such as Beta hemolytic streptococci, pneumococci or influenza organisms, were easily grown in cultures from the nasal passages or pharynx; furthermore, subsequent surgical procedures often re-emphasized and proved the existence of an infection as a contributory cause of the nasal allergy. In our opinion, the appearance of the nasal mucosa of these patients is usually not only edematous but also quite hyperemic. The incidence of demonstrable nose and throat complications in this group of patients is shown below:

TABLE 5. ALLERGIC RHINITIS.

No. Pats.*	Age (Yrs.)	Nose and Throat Complications No	Nose and Throat Complications Yes	Type	No.	Per Cent
				Septal deflection	2	
38	10-20	32	6	Tonsillitis, adenoiditis	4	
				Sinusitis, single	1	15
				Nasal polyps	1	
64	21-35	43	21	Septal deflection	14	
				Sinusitis, single	15	
				Sinusitis, multiple	2	32
				Nasal polyps	3	
				Sinusitis and polyps	5	
112	36-50	48	64	Septal deflection	37	
				Sinusitis, single	48	
				Sinusitis, multiple	10	58
				Nasal polyps	18	
				Sinusitis and polyps	24	
73	51-65	32	41	Septal deflection	21	
				Sinusitis, single	18	
				Sinusitis, multiple	23	55
				Nasal polyps	19	
				Sinusitis and polyps	27	
287			132			45

*Unselected, consecutive ambulatory or hospitalized patients.

As expected, the great majority of these patients, with nose and throat complications, had a deflected nasal septum. The incidence of this anomaly, in our group, seems to diminish with age, due in part at least to previous operative repair. Of the 287 patients with allergic rhinitis, 74 were thought to have insufficient nasal breathing spaces because of an anomaly of the nasal septum. In this connection it must be remembered that nasal obstruction and mouth breathing have been incriminated as causes of sinusitis in children.[16] This is particularly true of children below six years, the age at which the mandible begins to grow rapidly to accommodate the permanent teeth. Tonsillitis and adenoiditis and then sinusitis, single or multiple, were the next most common complications. It is obvious that adenoiditis, or its equivalent, such as lymphoid hyperplasia in the nasopharynx, when combined with a deflection of the nasal septum, will further increase the incidence of sinusitis, particularly in the young patients; however, the latter was a very common complication in the middle-aged and older group of our patients with allergic rhinitis. The results of nose and throat surgery in these patients with proven nose and throat complications is tabulated as follows:

TABLE 6. THE EFFECT OF NOSE AND THROAT SURGERY IN ALLERGIC RHINITIS.

No. Pats. with N & T Disease*	Patients Treated Surgically	Operations—Type	No. Pts.	Results 0	?	+	Per Cent* Benefited
132	128	1) Submucous Resc.	52	18	19	15	65
		2) T & A	4	1	—	3	75
		3) Polypectomy	29	7	10	22	82
(287)		4) Ethmoidectomy + or sphenoidectomy	26	16	3	7	38
		5) Caldwell-Luc	17	11	3	3	35
		6) 1 + 2	46	17	20	9	63
		7) 1 + 3	63	10	18	35	87
		8) 1 + 4	51	3	24	24	94
		9) 1 + 5	19	2	5	12	89
132	128		128		85		66

*Percentage calculated on fair as well as excellent results.

Of the 287 patients with allergic rhinitis, 132 were found to have some type of nose and throat affection, and of these, 128 were treated surgically. As was expected, the great majority had a submucous resection of the nasal septum or some similar operation, and of these, 65.3 per cent were definitely benefited. Tonsillectomies and adenoidectomies alone were rather few, perhaps because the majority of these patients were past puberty. Polypectomies, ethmoidectomies and sphenoidectomies were done on 55 patients with excellent results. A Caldwell-Luc procedure was done on 17 patients with a beneficial result in 35.2 per cent; combined or multiple operations were performed on the majority of these persons with an overall apparent beneficial result in 66.4 per cent of the 128 patients surgically treated. Again, most, if not all, of these patients were treated with desensitizing and autogenous vaccine mixture, yet we feel that the beneficial results reported were due in great part to the necessary surgical procedures.

Perennial Rhinitis: These patients, 93 in all, presented a most difficult and trying problem. They complained of more or less constant nasal discomfort, and the history is rarely of any help in solving their problem. Undoubtedly, patients with so-called X-hay fever, as well as many with psychosomatic disturbances, are found in this category.[17] In 49 of the 93 patients, some type of nose and throat complication was diagnosed. This is an incidence of over 50 per cent and is summarized in the next table.

It is obvious that the types of rhinological abnormalities encountered in this group differ little from those found in the patients with allergic rhinitis, although the occurrence of sinusitis and polyposis in the patients with perennial rhinitis is perhaps higher, particularly in the older age group. Surgical procedures were performed in 44 of 49 patients who were

TABLE 7. PERENNIAL RHINITIS.*

No. Pats.†	Age (Yrs.)	Nose and Throat Complications No	Yes	Type	No.	Per Cent
14	20-30	5	9	Tonsillitis & adenoiditis	4	
				Septal deflection	8	
				Nasal polyps	1	64
				Sinusitis, single	3	
				Sinusitis, multiple	2	
52	31-50	31	21	Tonsillitis & adenoiditis	5	
				Septal deflection	14	
				Nasal polyps	8	40
				Sinusitis, single	7	
				Sinusitis, multiple	9	
27	51-65	8	19	Tonsillitis & adenoiditis	1	
				Septal deflection	3	
				Nasal polyps	9	70
				Sinusitis, single	3	
				Sinusitis, multiple	14	
				Polyps & sinusitis	5	
93			49			52

*This group includes, undoubtedly, examples of so-called vasomotor rhinitis.
†Unselected, consecutive ambulatory and hospitalized patients.

found to have some infection or other complication in the upper respiratory tract; this means that 89 per cent were treated surgically. Again, a submucous resection of the nasal septum was the most frequent procedure, but other measures, such as polypectomies and various sinus operations, did not lag far behind. Beneficial results ascribed in great part to

surgery were observed in 25 patients, or 56.8 per cent of this group. See table below:

TABLE 8. THE EFFECT OF NOSE AND THROAT SURGERY IN PERENNIAL RHINITIS.

No. Pats. with N & T Disease*	Patients Treated Surgically	Operations—Type	No. Pts.	Results 0	?	+	Per Cent* Benefited
49	44	1) Submucous resc.	6	2	2	2	67
		2) T & A	6	2	2	2	67
		3) Polypectomy	2	2	—	—	0
		4) Ethmoidectomy + or sphenoidectomy	4	3	1	—	25
		5) Caldwell-Luc	3	3	—	—	0
		6) 1 + 2	5	2	1	2	60
		7) 1 + 3	5	2	2	1	60
		8) 1 + 4	4	1	2	1	75
		9) 1 + 5	5	1	2	2	80
		10) 2 + 5	4	1	1	2	75
—			—		—		—
49			44		25		57

*Percentage calculated on fair as well as excellent results.

Atopic Rhinitis: These are patients who suffer from purely seasonal rhinitis. Their family and past personal history characterizes them as truly hypersensitive or atopic individuals. Yet, among these 74 individuals, there were 24 in whom a careful nose and throat examination disclosed the presence of some anatomical or infectious complication.

TABLE 9. ATOPIC RHINITIS (PURE*).

No. Pats.	Age (Yrs.)	Nose and Throat Complications No	Yes	Type	No.	Per Cent
12	6-15	10	2	Septal deflection	1	18
				Adenoids, etc	2	
33	16-30	21	12	Septal deflection	7	21
				Adenoids, etc.	3	9
				Sinusitis	2	6
14	31-55	7	7	Septal deflection	4	29
				Adenoids, etc.	1	8
				Sinusitis	2	1
5	56+	2	3	Septal deflection	0	0
				Adenoids, etc.	1	20
				Sinusitis	2	40

*Purely seasonal history.

It is not surprising that an anomaly of the nasal septum leads the list. On the other hand, it is obvious that the complications of a bacterial nature, such as sinusitis, increase with the age of the patient. The effect of nose and throat surgery in such patients is excellent. See the following table:

TABLE 10. The EFFECT OF NOSE AND THROAT SURGERY IN ATOPIC RHINITIS (PURE*).

No. Pats. with N & T Disease	Patients Treated Surgically	Operations—Type	No. Pts.	Results 0	?	+	Per Cent Benefited
24	11	Submucous resection	7	2	1	4	71
		Adenoiditis, etc.	3	—	1	2	100
		Sinus operation	3	1	1	1	67

*Purely seasonal by history.

Of the 24 patients with atopic rhinitis, who were found to have some infection or anatomical abnormality of the nose and throat, 11 were treated surgically. Even though the group is small, the results speak for themselves. In this group, again, the removal of an anatomical obstruction by a submucous resection of the nasal septum, and the eradication of foci of infection, most often in the adenoids, proved very beneficial.

Urticaria and Angioneurotic Edema: The problem of urticaria and angioneurotic edema is perhaps the most trying, and the treatment of patients afflicted with one or both of these major allergies is most difficult. We refer to adults and to those patients in whom a psychic conflict is not the obvious cause. In our experience, bacterial allergy is the most important precipitating agent.[18] In our group of 112 patients, some form of bacterial infection was found in 43, or about 38 per cent. See the next table.

TABLE 11. URTICARIA AND ANGIONEUROTIC EDEMA AND THE INCIDENCE OF NOSE AND THROAT AND OTHER INFECTIONS.

No. Pats.	Age	Nose and Throat Complication	No. Pats. with Corresponding N & T Disease	Other Complications
18	15-20	Tonsillitis and	10	Dental 1
		adenoiditis	3	Gall bladder 1
		Sinusitis, etc.		Unknown 3
39	21-35	Tonsillitis and	8	Dental 8
		adenoiditis	9	Gall bladder 6
		Sinusitis, etc.		Prostate 2
				Unknown 6
31	36-55	Tonsillitis and	2	Dental 9
		adenoiditis	8	Gall bladder 7
		Sinusitis, etc.		Prostate 1
				Unknown 4
24	56+	Tonsillitis and	2	Dental 1
		adenoiditis	1	Gall bladder 5
		Sinusitis, etc.		Prostate 1
				Unknown 14

The site of the foci of infection in this group of patients is quite variable. In the older age group, infections in the sinuses, teeth, gall bladder and prostate are increasingly more numerous. The patients with this type of an allergic disorder should have a thorough medical survey, and the exactness of such an examination will usually determine whether patients with these allergic disorders are helped or left to suffer.

Summary and Conclusions: We have studied patients who were unselected examples of one or more of the major allergic disorders. Of these 911 people, 440 had some type of anatomical or infectious complication in the upper respiratory tract.

TABLE 12. INCIDENCE OF NOSE AND THROAT COMPLICATIONS IN FIVE MAJOR ALLERGIC DISORDERS.

Allergic Manifestations	No. Pats.	No. Pats. with Nose & Throat Complications	Per Cent
Atopic rhinitis	64	24	38
Allergic rhinitis	287	132	46
Perennial rhinitis	93	49	53
Asthma	355	192	54
Urticaria and angioneurotic edema	112	43	38

Of the 440 patients, 315 were operated upon. In many instances multiple surgical procedures were necessary. Although it is difficult to evaluate mathematically, the results of the indicated otolaryngological treatment, the analysis of our group of allergic individuals suggests that it was beneficial in at least 50 per cent of the patients. The primary indication for surgical intervention in allergic people is founded on our growing understanding of the existence of bacterial allergy.[19] The difficulties in proving the existence of bacterial allergy by the methods now available are obvious; therefore, we must rely on clinical observation to evaluate the efficacy of surgical procedures which were done to eradicate foci of infection in allergic patients.

Sixty-nine per cent of asthmatics, an almost identical percentage of patients with allergic rhinitis, and a smaller percentage (56.8 per cent) of sufferers from perennial rhinitis were benefited by the necessary surgical nose and throat procedures. The operations carried out upon patients with atopic rhinitis were even more successful. In the patients affected with urticaria and/or angioneurotic edema, the results of rhinological operations were by far less decisive. There are undoubtedly other otolaryngological disturbances which are probably of an allergic nature,[20] but we have confined ourselves necessarily to the more common major allergic manifestations.

1. The incidence of otolaryngological complications in allergic individuals is high.

2. In a group of asthmatic patients it amounted to 55 per cent, the frequency of such complications growing with the age of the patient and the duration of asthma.

3. Beneficial results of the nose and throat operations in asthmatic patients were observed in 69 per cent of 152 patients out of 195 asthmatics with nose and throat complications.

4. In a group of 287 patients with allergic rhinitis, 132 were found to have some infection or anatomical abnormality

of the nose and throat. Of these, 66.4 per cent were benefited by the indicated surgical procedures.

5. The incidence of nose and throat complications in a group of 93 patients with perennial rhinitis was in 49 patients. Of these patients, 44 were operated upon with beneficial results in 56.8 per cent.

6. In patients with atopic rhinitis the occurrence of nose and throat complications was relatively fewer (about 35 per cent), and the results of the necessary nose and throat procedures were most satisfactory.

7. Although the presence of bacterial infection, and the consequent resulting bacterial allergy, is, in our opinion, evident and important in patients suffering from urticaria and angioneurotic edema, rhinological surgery has not proven too helpful in our group of patients.

In summary, it is obvious that a large number of allergic individuals develop, sooner or later, a hypersensitiveness to bacterial products. It follows, therefore, that proper surgical procedures directed to remove the foci of infection, in this instance otolaryngological operations, are essential to solve the problem of these patients.

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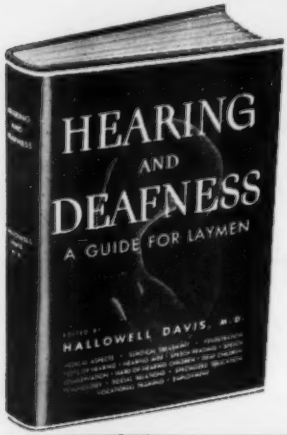

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